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		****	ノン株式会社内
		Se 200 0 10	C127 4000

			/: #E#### :/
		5 A-4.0	FA-LIST CHE WAS MAD ON CHE CASE
			9555

88

いっ (後のかの名) 美術の木が着り大小

然をないたを開始とする の、サビ、大学を対象を少ない、世界が近、他の様から ※には、食物を実施すべいれるサージを変わられたから [1002] 水源は上海が水水の流の流の水が上がった。 のこか

終日後の後は病域には治療制の表現人がよれ、足数人に たーンの神経が発展的はなななどのは異なるがなるないである THE PROPERTY OF STREET, P. I. VANCOURSE

CK627

8

与对人口的——1000年的发生不是有过的自由现在的现在分词的现象形式的现在分词的对比,可以会对一个不会的一个人的。 中一年期中的的有关的教育的教育的教育的教育的教育的人们的教育的教育教育的人们的教育

「銀の銀子」 (W 10 18 3

産物物の中華物に出すた、気気物に多味の水が食物の不用食物のちょしつ。まに、ほど >、一口、 四至、 沒於於使冷以引動數數的於心數數是從行為財務必要節號的契約的可能。

中国の報信以外の報告を表現の別の別の報告を与けるはののののののの **张妈等决办中发现门等177、米班的目录的专程出来每年每分月——每二年指数与1777到775** [30 m m ?]

(8888) の他の日然親の繁殖原本の報じ水下。

後記録状の中級数は水泥敷的物とつなることなる数にする深点はしな色ものがあり指移 (# # # # 9 J

然以发现出在对话 女信 () 你有一点学说早来这个中日!那是各种《少有诗》、"不是我们不知道,那是一点就有了就有了就就是我的就是我的我们,我们是一个我们,我们可以就是我们就是我们的。" (0 (8 % K) 3

我們也像像な旅のアモタンクスションが年後のようなの形を含むことを答案とする 【游水椒11】 1000

《新原记》本人《《《》以上在代现代》都有许公理和表示的《新日报》《新原记》 (强众约张器] 学年業のあ

バートンの内部な扱格は自然的最大な多力な影が水を影響をある機能に減率を強ったいます。 いの高級資本の機能と使率なお人を影けて、アチャンンが出た第四大者に大量に大量に大力を持つない。 第二つれられ実験なくなる英語がもの成立るな。から確認を残ら一つここに表示る人にする。 少, 減下以、 泡如光片聚落安馨 八丁的纸中布的架下八层彩牌看黑的复数形式,小之下

5

常田子の名ののサル **あかない ※中午の**

の政策を表すった。「の政策を表すった」である。「の数年は民意の構造の対象に関する。 の数年は大きないる。 の数年によっては、大きないる。 の数年によっては、大きないる。 の数年によっては、大きないる。 の数年によっては、大きないる。 の数年によっては、大きないる。 の数年によっては、大きないる。 の数年によっては、大きないる。 の数年によっては、大きないる。 の数年によっては、大きないる。 のまたいる。 のまた

は19高年報達とよれて15高級的に最初の選択を開発が設定に及び締めて55点が近年では中心に対し、他軍中部に指揮をある地域が10高級である機械である機械である機械では 他のごと利力が他に変々は、条約は減少、後勢が攻撃に砂密機。。。 「ののの~1

36 .50

報を報

Š

二 的那品 高機器のようです。 100001 (382221) 1 + 10 × 15 40 1 1 第 2 % . 5 . 5 8 2 8 22 2. 19.24 19.00 -30 1 AS 如果我说,你用她都是我们 有14年

事務器でみるか

30

0 4 ė

然而是、自己对本品现象基本图5.《克里斯摩》《春春春》 第四次也未提供自己中华。 、中部の部本本人の父孫が今の本会、 1000 、中級次の数据者未然であ 放放 分并 外放器 不行 14

、「大くの実際は1回で東京の開業を実施で、大阪な事業へ、生態を含っているである。 には大阪に、大阪場所で、一直で共和では、日本では、日本では、日本では、100年である。 でいったのでは、「大阪場所で、100年では、100年では、100年では、100年である。 にいったが、100年では、一門長が場合を開発を開発した。日本では、100年である。 にいったが、100年では、100年では、100年では、100年では、100年である。 100年では、100年

は高級機構部の対点機能とが悪い高額的が銀形の影響、大磁管門でなった機能を含む系統 当に成果を与める自然を与えてある。大統領域の影響を実施的表面は、可能はなれるを、 (つか・こ) 1、色色を含金金が大成るのが落なだの大って気候を打成したの間に一般の気候を放在することは表象である。 のこの間に一般の気候を放在することは表象である。 ę, 治療が 8 2.11

はよって多額的要果があれるもの深るようかから、中国多味を取出されませず、ようなできたでは多いできない。 つずつ、主張をがを放出された、実施ので発出を表に表していていません。 つずつ、主張をがを放出された、実施しているとのでは、実施ができ、終し、全部のでは、対し、対しているというには、はないでは、は、対しているというには、はないできた。 日本文とは、は文学的には、へんない

を発送され合めのおのな数な姿をは成しれたをはればまるが、単級をないにいたため、 で、予診機のつれが変化が存储機能がは、大変のゆつれ、液性を気を表であられては 外側に対するアンで数化が成化機能が、大変のゆつれ、液性を気を表であられては 小機に対するアンで数化が変化。 ロップ科学の影響につ、後でも機能な多数 の実施は対象性を対象となっていた。 10014

\$ 00 pg 166153

(三) 海線管門鄉天倉衛道部以內衛 | 教授の根据を含す機関の支援の場で見りが発表して、 ののかび寒水をゆるが寒ののひろろれ 京都教養さいのとを選び替出 38 はおおに

(4) 有电话记得经验的过去式和现在分词给了专法的过去式和过去分词的过去分词 (5) 紫紫花红色灰色香油中含化香色色:第二甲烷基合物与基合作品 衛者都以以祭者

北田水川

大学学工177

(3) ※銀粉に巻

米の別数数数の水分割数4 S

í

9 89 .

83

2

25.50

8

《中华教教院在其中中文学》的日本教育中中, おおとなり **

100 At 88 不然 學 不多 6, (2)水果銀器、 **** 実験係の形などあるシャニッニロン 展示器ない 2. は、ため、大人を使って、こののをはなる。 5000 李京 在 第 在 京 於 申録な場合の

後の 対策 発展 記載 C 58.85 X 20 0 20 3 è

æ

100121 . 华兴场会观

6

2004-200853

2 7894, 10, 71

200 12

電子の関係を表する。 (A 1/4 できました。 (A 1/4 できましん)) (A 1/4 でき 6 1 0 0 3 巻いの1年形がまたにいる。然の人、成務に正字形態落のものものチェンスのなを乗じ

(0020) (の強にた様々ななする場合の流れ機能の機能の機能が弱点機を示す

人は当来提出場場に対象的で、中部でも最近の中で、介質のものは、対象的に関係しませる。 は、当本を基準を実施していません。主要が、大き様の、主要を指数を基本を実施しているがあっため、一定の表示と変更しな。 日本の表示に対し、自己の自己の自己の主要が、表示している。 日本の主要が、表示している。 日本の主要が、表示している。 日本の主要が、表示したいる。 日本の主要が、またいる。 日本の主要が、表示したいる。 日本の主要が、表示したいる。 日本の主要が、表示したいる。 日本の主要が、表示したいる。 日本の主要が、表示したいる。 日本の主要が、表示したいる。 日本の主要が、またいる。 日本の主要が、またいる。 日本の主要が、またいる。 日本の主要が、またいる。 日本の主要が、またいる。 日本の主要が、またいる。 日本の主要が、またいる。 日本の主要が、またいる。 日本の主要が、またいる。 日本の主要が、またい。 日本のまかい。 日本の主要が、またい。 日本の主

報告の様と人な 0 2

成者でついたでの対象を表現している。 を認めておりないまります。 を表現しております。 を表現している。 をまれている。 をまれている。 をまれている。 をまれている。 をまれている。 をまれている。 をまれてなる。 をまれてなる。 をまれてな。 をまれている。

市、中のは、後の最初をは何かなど終りまた。 着な動きが続けられている事を だがなから近いでもあかができません。 かった に、他へと指導では、他がながれば、他で成場ではなった。 実際医の他 に受いて、他のと指導では、他のできなが、他の場合はなったが、実際医の他 に受いて、他のと指導では、そのできながあるはなったが、実際医の他 に受いて、他のと指導では、近のではないないない。 表の器

2

100003

茂の出たる物理

8

があ、高され、他次の光光接着の本語を表示を表示があるという。当日、現代できた機能が思想を含めませいた。はもわせいるはいという。当日、現代できたのでは、現代できたのでは、現代できた。 66255 · · · D 3 8

ののでは、大学のでは、大学のでは、大学のでは、大学のでは、一般のでは、大学のでは 190561 第二条以下有效的方式。并与用数数个不适。这个等级正常个条本的条以其中的多类的数数。 W # 17

100273 强于严格的人,只是是这个全部的人。 计多位数据人人说,这个是是这么一,这条中,就被打造了你们是这个,就是是这个企业,就是不是是不是是不是的。 5 pt 80 N 12 N 20 20

の少れ、解決さら機能のない。 木の物を造成されるや金融を取るようの大型を のと実際を設定する。 かっかい かっかい かっかい かっかい から数 を構造に関する。 かっかい かっかい かっかい かっかい かっかい から数 が送りませる。 は他のようかい かっかい かっかい かっかい かっかい かっかい かっかい かっかい は他のませる できない かっかい かっかい かっかい かっかい かっかい は他のは他のない かっかい ない かっかい ない かっかい は他のような かっかい かっかい は他のような かっかい かっかい は他のは他のない かっかい は他のは他のない かっかい は他のは他のない かっかい は他のながない かっかい は他のな は他のながない かっかい は他のない は

13

00 100291 、 教育的第四条件。 4 0 X X X 4

土電光をはよってその条件に関係が、最終に電話がから映像を表示ななのでについます。 10ののままだが、多様のでは、 密密を表だをおける場合をは、現実がよりを対しませましませましました。 密密を表だをおける場合をは、は、では、大学がよりがありませましませました。 では、0月10日でもは、15年では、 の知识とであ 86 き、多妻様としては

中華語言學問題以前 がな、なかべは、手 で、から減減な疾病 £ 8 11 100 然是在軍人以及以外衛の下京縣 100 なが なべ かん 80

然いれいスソアダンシアドチェチー、)、AeS式成してたさったの、日本名では、大変を占備する不満議会の日本あるにお願います。

※の様に 総の ア iĝ \$ 7 W スクロはソ発発 小學學 W 50 各場のお 公安 四四 奉行 30

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\$ 0 de

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2004-196652 A 2004, Fd. 2"

おかつとなり シングンをはるないないのであるとなっているというできない。 2 8 2 1 * - 5 4 6 % * 6

果然年代, 然為出力的品質的語 報があるこ 2000 1 第六年 7 日本路路の第四条路路 9: > 株本等等を出い

次の考別のの成立 【のの第四】 「なのの第四】

000 Ġ 38

5% 報的意 依因与按照例以指揮出版分以因以布點按所接接所以其其正法 ちつぎ、第2の深語器の場合の 20年前四年四十二日 各物物 我们有对了几个只要让我一个女子和是是不在第二天或者的女子不是打造的女子的人的人的现在分词或者是这个女子也是不是我们就是有一个女孩就是这个女女,我们也不是我们就会会的人,我们也不是我们就不够的一个人,我是我看到了一个女孩的人,我们也不是我们就 (30 00) 8 ※ 報告の は 多 な 郷 報 な

以合意含的多以人,多多常是各位含数?,各位数数数时间内在,最来源,老者是整张, 1000、以来VPR,是一位400、发出,从由、从由、1000、发光,1000、以上,以上,以上,以上,以上,以上,以上 大は女子又 おクミックス、ガライヨーが知識に近いられる。表表のはは異常な異常な異常な異常につれ、数れが今れが思想に出い、 表のには異常な異常な異常な異なました。 現る物源、代言品にごの物質は影響がついた。 美術教育をついたは、ルニストルキルの中でで、アースの主の手で、から「こうを生き」では、アースのアン、アニアの大学の表現の影響を表現の表現のでは、アースに対して 89

東京法院教院は、京都線、安全では古代統治教徒の・・・・・のませき形成の作のサイフにより上げいかがたに称りた中で、東方は、東京、大阪の山村の大阪の教徒を受けませた。 1、日本の上の日の日本ではありたけで、東方は、大阪の山村の大阪の山村の東京によっていた。 ģ

00303

> 然合意意 の実験部の景をは、1 中国各門以後衛衛衛衛衛衛 0 34 アン部等な、水泥液をゆる総

100011

のなましゃのメニが総合を認め、ひれを声かかなる。代だ、成が改成のきめなどでは実施が感が変数になってもなってもないである。または、パパンクシングはコラットは、経験家がないられ、、然後歌奏を行いられ、、然後歌奏を行いられ、、然後歌奏を表行って記念が記念されたと、

[8043]

本金数色の近点を指述った単立にはこれの中の形式はなり、の単常、リーの単分やパネなか、近常機が実施するが、一定の場合では、またのでは、一定の場合では、一定の表のでは、一定のでは、一定のでは、一定のでは、一定のでは、一定のでは、一定のでは、一定のでは、一定のでは、一定のでは、一定のでは、一定のでは、一 4 公院公公 每晚級等等項目出口の (0044) **** 200

0

李宗郎 少公郎 新李 ※ 義氏等かつれる数 き間前者オマ及これ 0.000 80% a C C. A 所以の方を打法機 ※出版の中部のこ

教育議会会会

(H)

総代の土炭液の生産液は遅りを含む。たれれた、ドラインのなをごって、東洋の機能を、スペックルンとは、総種を用途、ヘルの近、スプラーを表現を進んされば、なられた、多様を エッチングが発行られる.

※※さべらかつ *

第2条を含えないた以外に対しているのではない。第2、これではなるを必らななるをあった。第2、これではなるを必らなるのではない。第2、これではなるのではないできる。第2を表示している。 # #6

85

33

9 20 ×

36

2. 注:中心少期限分泌下深度の異胞や共識多別の数なの。以数例を入りられた。其上を 109433 少有明马公公务司等等. 市以珍豫. 11/10 素強物の残な高いあるに年になる。 北部北部沿江、米路が場ついた

- 佐州成務院、北大において左、諸原原原は、たの原原の子により、 佐州成務院、北大において大道、諸原原原は、たの原原の子になる。 後のからにものからい スプを一様、 200 40 *

× 88 × 1 100501

17年17日、大阪長の年後な火機関をあるた場合で、大阪長の年後などの大機関の大阪会のためないのようなない。 完全本本等器照八数 むなれ場職の機器を必め、 20 衛公米

8

(X 22 X ...

建一分减分配置口下,一颗加发色素等的心,一定为白,自我是精力水平。该与分别是是一个人,这是我们是我们的人,是这就是我们的人。一个一个以外的经历对信息,我还也会跟着几个人都会的多年,我就是一个人就会的自己的最高的主要我们更不会无效的时, 8

1997年19日15日、東京本部等日へ本知る金、第四の外の政治党の国家教育家を介置する。1987年19月18日(1988年)に対象の、成の存せらの「1997年19日)

*** ||『ハックのあらの対象がありの対象を対し、常々ののののこの多数化物をおれた物を数数をあります。 「2歳、どちジンガス巻いの中間。/ 出すれ(ちゃくびねこ)実際で、たる高級客です。機会の景楽を中、なってのカッチアやればなける! 50

のでは何は 発表のよれで 光線がの きゃどん …からい、 香味的となり アキャスニーから ロぞの何は 発表のよれであっ 衛子 サイス …器容 ジー サバブレッカル いっめい にゅん いっしん いっさい にゅうしん 大震楽の ありべつ気で変めないでき

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100843

- 1911年におけるのでは、 1920年には、 1920年には、 1920年により、アルアナのアウトのドランをは、 1920年に、 19 8 88 38 C S 25 85 10 *

※米などのはなな姿勢の .31

いのどうな条約等を高級部を提出った、乗りの点を集りを扱うのに作る表にある時でも、 00562 33.32 のの名と養物が

3000

12 36 17

		*	8 % 8	Q8.5	38	6 (i 4	
		2	2	2	Ĕ.	57	
	Sign Sign	40	٥.	\$ 87.5	M	\$	
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S.	88	9,03	0 04	ş	3.4.0		
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G G	28	330	163	2.3	Û	*	
**	Ĉ.	ij.	ette	57%	i,	23/4	
ŝ	3	8	**			2000	

ŝ,

党兼大學院多 卷。 シーネタスのたのセーシャ |夜殿鏡です。現像への一条の鏡のサダートの一名カンドでは「エテッツパートの一の夜殿鏡です。現像への一条の鏡鏡のサダートの一名カンドでは「エテッツパートの一名の変形などとなる」 突然像 4 0 2 全等像社会 80 機よの! これ乗りに 22 2. 大汉下の中縣計學口の民國 22

8

165003

民門、デーマスやシャロンが展示、越密やポジーのローのティンミーのロルジエ密接条が1つの大容響があった。 第二の大容響が少、様子とマスガイやの、1つの、1つの、1つの、1つの、ローのでごりを終れ、成的と競技が大打ちは動物等がどの指定を表がら、現代では大容が大路が大路を持ち、一分では大空響で、大きマスにでプロの回りの、1000円の、 (0000) 77682356 C 38

こうなサヤンボータの言をあをせいパーでのもへ複数する。

8

教教を与り、いいがオンス・トカルのフが教教を実にしまた必然のよれる、只知の行は、「然教が実施を施行される。人、教教にしまたが決議を発出な数な行為、表教としまたが、大学を表示ない、大学の大学のような教教にしまれる教教にしまれて、日本でから、「アンジが存在を立つだけ、後述を表示しました教教にしまれて、日本でから、「アンジが存在しただけらればない。」 200003

200

8

× 19

等が高級がなれば死 4つ ただと素味のここ 89003 他の一方方二十四日報送のお大!つの 1 % T 7 G 1 1 8 新た 136 *

36

Ö

200A-296652 A

38 7 10

○ 33 2 8 2 6 6 × 1 4 → をははする、から来、デンロー 200 年間日報以上 27 7 0 アタ・フェーニウのの名 ののなり様と 7 80 5 × × *** *** Al A SE SE **新** 第 第 9 第

三日 都然のカストア れしから様 中華報用的發揮與白衛與內部 (予報的人の1巻との3巻に、円 30

養の然に - マック・ロスをイメータ。"マルス教徒では、それが成れるなどのなったのながない。 - マック・ロスをのは教をおけるのながない。 - マック・ロスをのは教をおけるのがなる。 ロボルタキロールを出て八橋後後標があので、ナーアンの八橋線がある 如今、分類保証し、のこのか出のグロルが存留された数形数的数の数数いの。その後、 38 れ、一つ接続する整数接換による参数器でれるメインが物的となったった。 5×272×23 S O C M F /# 10 (20 | 20 | 1) 報報と、 第2000 × 3

100057 ** ** 京都はの * 8

*

× 0°.

88003 「1.のアンコの」というがないが成れた必要が近代の姿勢の基礎があったがはな気であれて、1.のアンコの」というのがないが成れるが、それにいかがありました。 一、スタザテロ8、クロのを回じた インの名 てののを照けて深灰のカゲーでのとを流 *

でのなく高数のなど 8

三指公院在市下行為所名所等於 原及獨有所為之類擬名稱 a

3/高樂也公. 行於の正常のの内容器点の 些無確以立門飲成人のこ これの十分にがないが後、タードスラブシャンを送び、タカテナでは地域ではがよったことを対しては、 - アチャンパー 4 ~ 23

上窓と発表になてアン ひーのそのこと、一下のの場が西路衛のかめるののいの次の \$ C 2 . 8

ウドニウト成素の皮膚の皮膚の皮膚では、全食は40mm×40mmの皮膚は、口皮膚をも変には、全食は40mm×40mmの皮膚にして皮膚をして、皮皮は40mm×40mmの皮膚にして皮膚をもあれて、ど 来た、 落成をじのマグニトロンスパッタ安然のアノーニの表表に伝われの、 スキンレス教 **ルススをスパッキリングこれ**

下口不用的情格下心马数据下的,数点影像以一般的心外以几次有形体的色彩的点影影 公司 衛衛 等 等日 在 其 上 中 . 原表巴黎等在公司 人名人名白縣山內非二人亦亦 M

人名本等こ

・ では、 できない。 では、 できない。 では、 できない。 では、 できない。 では、 できない。 では、 できない。 でき 下語解与外語は大き、名詞鏡は整字介質類で有。ハウトハを繋で作れてデタを上記 33

500 139757

8

\$P\$、繁荣的高级2000年月1990年8月200日,1980年8月19日,1980年8月19日,1980年1980年,1980年1980年,1980年1980年,1980年1980年,1980年19 第表表とよるな観光する、この後、この後然の一体の表示を分を下されて発送し、 以为表表、學院不易以以及与發展した。發展分類心理發注、發展陰差形点形。 F 4 是出口 人の本人なの数別のロックにいり [0076] られ、心臓炎にズルーがは影響を2点---な理察のは、あらい、今中運動はブルスが発展のので、などには深に対しては10分とによっては、今月1分のでは、多のでは、10分とによるは、10分とによっては10分の

Ş

の原分は然かった。また、中国教育は > 0 0 m であった。 第二次、均数据公司以、主编据目的公司机会会的合名等目录 100773 [8 2 0 6 3 1783 大学 教養 なん

0 cm2)) 後後が、 間の以外の対象がカジャントの近 2 6 3

[0803] 在各的發生與發生或發生原本各種與於白色等(與4、1284) 克里里斯氏表示在數學是一种

ė:

Š 012

* 0 00813 'n 22 * とのいずにも名 * 50 年二 产品的縣

* 122 B

8 380

. 633

1903

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0540

× ×

N 1.001 98% 70 5. 994 3,003 ŝ 5.000 22.5 9,997 95

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你放下外親多称在 一本は、マネソや放抗学系的は 008 ・要はろれケナノヤ族なる政治が成立なななられ、 はつの政治では、公共でもの、世界が成立つ。対応 288 * 8 2

日刊书《以下书》与宋忠于高院与不容勒的落台或原数的故书的存入感觉或指令以为,父母与宠宗宗院已经明明,宋宗宗统统教授明明与明治的,帝宗院的传统了对于"大学"的 100803

38 33

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W. .. 182 × 1 湯を湯が 1381 8 85 8.2 6 800 500 500 金銭を ė: ~ オッチング製器 8 8 2

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848

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33.6

20

×220 *:C 3000 1 **第二回とは、一年の回収、公本の回答** 第二級の前の中の機器のです。 *** 8 62

※無限の強い ※やがあった。 様だのものは遅高に対して、外名後にはなっかなジャンプがつぶるいつのコの目がやか、できたかを、プチや機大の姿勢が大しかも影響でも表現から機関がないでしていないした。 そのかりを、他対し、例ののは他が対していまれる機能がある。 「終には、例には、例には、ののの場合性が行ったとなる機能がある。」 「終にない、例には、例にはないのはの治疗を行ったと音器をで表現されて行び、美々では、一般に 6002 2000年 2000 報がのお 李第四九第四、 郑明四级治安城中属公司教務京等

被判,在整一对先线数据成分与线线通信等在外层模型:11次60次分,与通过注意型(10次次)的通过注意型(10次次次分) [84843 100951 裏可多様もない 本の影響 W X 33

24.07E ##C/3E 32.878 22. A. E. \$ 0 Aug 1.00% Tan 1.065 1.909 . 022 7 . 600 80 2.022 983 35×30°

[00997] 外班司 100061 災寒冷寒 (後来)の服務に関いた。 松花病品在原因以此中格在原始以, 他心

č 200 8 20 E 100 N 0.963 5.000 5.000 1,000 3. 661 376 9669 2.095 0.99 0, 936 3,002 3, 995 1.003 1.003 200 95 . 993 1.000 833 0.999 Q. 99× 0.898 6.33 200

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888

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33

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· 在下、其他或者與事故的符合 0 43 ŵ * 2 Sec. 2. 2.

10100 仍然恐怕由於

80.00	*30	% 7.	200	#3 A	
		0.7	jii Oi		(010) (010) (010) (010) (010)
¥,	**	N.	æ	*	((%) ((%) ((%) ((%) ((%) ((%) ((%) ((%)
8	38	250	250	200	38 88 88 88

(e c c e) 已经被已哪是分别我就是一只然没行发现下去的最后,人们只要也是被我们的人们会是我们就被这些我们还有我的心理,我们是我们是一个人,我们还是我们是一个人,我们就是一个人,我们就是我们的人,我们就要会说到了一

100

8

8

M T	35 E	30	#JC	800	%3 5	
*** **** ***	\$0 u u.	6. 6 x x x 2	5000ga ⁵	\$100000	(\$00000)	********

000

・の性がありまる中部が記録の最近年代での他の「日本ははのなかに見る感でが水砂を送るのでは、 変数の四の大変があるか、本数数がほうただらないとのかにはたいかってはなった。 ためのカンドスに確定と影響がよくとが主義ので感染がないがあったられていないから ロスクの比較れる数なでは、というないのはないが発みないないのであった。 [0102]

[01.0] [801.0] 16 花の木

水子然在物類

S

	*****	*****	*****			
35/38/88	#3E/#1	3830/383	\$25C-125	#32:4X	#3A/R1	
1.009	\$ 0.0	1. 008	236.3	\$1013	116.1	380
\$10.8	1. 625	2.808	1.00	š, 955	2,252	9
\$, 000	\$18.3	1,010	3.025	\$. 806	1,847	7.4
	1.8%	1,053	1,955	1.929	1,083	266.
9,89710	9.76×16	2. 63 × 10°	07 × 84 75	2. 297 to	5, (2×1)	25%

88

別はる、演出の、演出や、英は中国で表別も中国の中国の中国の中国の影響を発展が表現で、あられ、変数を決議や変換第一定表現に立らな、使用の自己的語言と呼び出来、一つの形が、 数のでする

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2004-296652 x 2004.:8.2:

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0.989

0.986

87

0. 387 2.998

3, 986

2.984

8,917

9, 321

· 发力者以及此位的数字与每个分数分。发力并与字形形的表示。

主治療以外は他院院しの院院の他の外の際で、主然のはほどの知識を表れ有難でな 0 第一点心理操作地ではいる姿像を保護機能し、元ウッニを発育機能能、発したが保証があります。 に対けつれ、影力の政策が多い。ウェーの表は保証が、概定の手段を対した 例記され他を受け込むとというな対象が成れたなととが不知では、 4 W 20

一級銀銀子の

60:15

春馬衛子, 本三於少門於衛衛衛衛於 33

(2 - 2) 10117 58.2 4.5.6 3 3%45: 9 35 1284C3 € 20 % S

*

湯の以下サングの原本の端一口にかいたへ次和

基礎の最後の後の機能を必要を対象のでは最近な対象性の発生の目示されない。 これられるのは、またののののでは、またののののでは、これられるのでは、またののでは、またののでは、これられるのでは、またのでは、 (19 mm no)

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32

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% 71	Š	*	255	*4.5	
38.	***	98	38	2.0 de	の生の正常技能の影響が 会議的は大きながら(*)

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	86	***	10	·÷	**	25
	8	8	>:	2	388	νé
	80	-	4	8	3	*
	2	101223	85	×	24	3
	88	۸,	ä	v	0	13
	c	w	3%	14	10	Q.
	100		ri.	23	*	vi.
ķ	23		で入れの出路で発動した独場派は勢素のわれて多いで多数的であっ	45	38	20
	a		20	38	13	ia
	100		è.	*	83	*
	*		25	2	4	13
	38		28	38	32	8
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	22			4	×	30
	1			Ş	33	37
	1			4	13	8
	3			73	10	88
	3.			\$¢	12	38
	20			90	75	42
	14			がなのサンジのの様々の影響をスポッンが展覧した概念がひを深へ合ったこれにおけれます。		10
	労働の公式機械的展示の後別的別数な存储場所;の開発に報告した、その出来を終				2数のものの失数であった。予以数のはいぞたのがこだらなおは300mmであった。い	中华书的中心是我的法院都经验我的教育的人 黎马、魏氏心经现代的主义中的人的教育中的

[0323]

36.78

(20.00) 、磁素等有效效一并令使致效性疾病

à

September 1

3 1 388 8 3:

(金属)

40 ç:

	1. a.	*20	404	57 C-	260
RAME	9, 996	1.636	5.033	5.018	9.00 (0)
45.38:	1,60?	1, 538	. 539	3 556	5.14 / 10
30781	1 631	1 095	1.023	3,546	6 89×30°
STORE I	1. 669	1.003	1.017	6.050	3. x9×12′
12 - 22	0.960	1 386	200	000	100000

% S					
	745	×	W.	.333	854
94 20 20	1, (843	0.391	1,000	0.888	9,995
28 26	1001	9.926	5 89	£ 1993	0.707
**	1,300	\$ 998	1,900	1 087	2.992
37.8	3, 000	0,825	5.663	2.5%	0.997
e je	5,000	3,988	6 998	28.6 43	65 178 86

0.

×.

(ウェイ) 2日教授がか、後の中午完全におけれ、物理は生態資料の接着が会議を行っていません。 のものはは、ののを見せなのは無されていませんからな。 101233

第一の古代教士は十二、答字が保証者は、「エラットを認める女子、はった光路をながってい、「妻子の子教育はい」のリーにはははないな、「我の上年後がは、我の上年後には、「妻子の子教をは、「女子の子教をない、「女子の子教のと、「女子教の子」に無難なればした。「女子の子教をない、」のエングの主義の大学の「大学教の」に 10:291 (※線派と)

・電影が正式発展室、収益を含めた影響、「影響を改せるなどを指して影響を引きるなどを含めていまった。 一定 は、 できない 一般 できない 一般 できない 一般 できない は、 できない 一般 できない は、 できない はん できない はん いい はん いい

0 g

源於 然為 第 今 發 節 [8:3:3] * 樂都樂職一西門獨大各所照於

10124) 80 × 報源の 25 00 N 20 0 21 \$ \$ \$ \$ \$ \$ おおおない × 中心然以次分 24

金額の資業率 18833 (% : %)

> 2 æ

大公の) こびのにが

· 不然無常然

記録者、

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\$5D \$50C 983 3 XV.A

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	¥	2,	808	.333	100
ž.	5,049	0.395	1,000	0.888	9,995
255	300.	9,926	- 69	£ 1993	6,507
7	1,000	0, 998	3, 903	1,00.1	2,992
ë	3,000	0,825	5.693	e 196	0.996
÷	1,000	3,989	o 993	28.6 43	8.278
	0.837	9.256	0.994	9, 977	9.321

「自己ながシンチが有子指摘な業業の高金貨業でなったが、既る施送場に当治な実がとってを表達しませた。当代、生産セチンドとも繋える物質が大いと大い原元に高度はなから、 際の40とからからからで、大人をお勧減の場合に対すせて水池が設計を開発に高度が大い。 「その1の分割ができ、 3838 \$5°C 200 385 A 4.8% 2536 2909 800 ä 33 ç.

京大学(100 top)

八四衛後 5~

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2004-2956\$2 A 2008 10 25

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2004-286652 & 2004 10,23

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Sept 52.25	8257.35%	\$10/8B	#SC-303	\$36,85%	*** 4.355	
	1.034	1. 0/29	1,021	1.005	200	325
	2, 989	2,987	1.00	2.399	p. 997	3
	0.997	0,590	1.003	9. Sept.	:: 8::	700
	1,929	1.031	225.3	1.963	1.042	332
	6.37×36*	6. 35×39°	5,58 × 65°	* 25×30	1.25 × 50'	20.5

公瀬子. 4 , 只要你因然外所必要一個原在打造之位, 學學接及器是然可以所以於於於於如, 強以

0:393

,86 424 277	38%	#67	2000	% 53	#55.A	285	
6,999	1.060	0 339	1.005	1.699	1.00	1.003	340
6,999	0, 369	0.559	d. 966	6, 997	6, 996	9.998	25
1,000	: 98:	2,082	1, 862	1.003	1,003	1,000	ŝ
\$ 998	1. 866	6,999	0.998	300	1.001	6.399	err.
9,998	3.993	\$.998	986.2	0.99%	9,993	9,399	se lir

200

52 *** ***

然及學為亦然然丁二 了完全教育全全国全个人的基础会会的基本人们,自由自由人的表现上的表现上的人。 这转几条中分型,一个对象的人的国际人们的人们的现在分词是对于这种人们,这一口间是我们就会会会不是一个人们的人们的人们的人们

0266 出版の影響事態を影響のなる

8

103

# 1001 ENCOR	#407/25 1.003 1.000 #187/155 1.003 1.000	10.3	表100米酸素力器 第50米級基分系	
	1.043	1.007	9	

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ä

含色磷酸盐酸合物酸氢酶氢酶或过 "然心人,我心也,我也也,我也也是我会心实了于我是一只不知者,我也可以是一个知识,我也不不了。" 计自然表示的 "就是不一点?" 統一の水理機以際の物質に機器はやかせのか、シののはついの指揮したいる、 203403 27 36

4

对法属者恶人,或指挥使给养力量以对外,能力力、自然发生的是现代的一口:用这一点,也不是分离感力的功能,就是就是接着我们对对对的对人 **锡据是以此代入口》。此时、张田子将兼张黑巴瑞武马华强物的统治院的宗书中也也是、据《** 改计方数微管心、微磁切存、体化心影像影為或片数或料、表彩思点影使点一等對外觀点 50 ; [0:47] 6 6 5

8

八級學院四

出立さが高額な200円では、100円では、 10:483

合題雖沒な品質無常一口需要与確如人以 [8:48] 然でい. 会の様なななののを変をあれる様のか

子祭務や発表やめ行るさを残ら救済をデキーローに入ったデーのことの以外に行わめばお募金のな。 ※ 第 (中国等) 下班第 7 . パカ

-

本古後、アウ以い点にからの人を、 まーロ(ロットのメーン 医療は、用むなパメーの、でった実際では、作み解析、解釈解析のこれの人の発表で、ラーロになりを表示がなる。

6、年のの参照イントではドチャッド教育部教育部の存在としてものを提供的では、 原列の階級の参介インドゥルの教験では、 衛出谷軍具出

1720

3 4 5 ・美ロ目した、光気の姿勢の変数を発力器ののでき、 インプロスケアのロース も形した 高級なる変数を発力器のできない。 ※これはエグングを含った。
※エンジには然業はあた。

とりには極端的なソビや グの非常な、独的なソビ 3 での政権を終めては、下分々人 での政権を発すては、不少人 126621 一年 1997年 1997年 1998年 19 1388 03

	of 61 01 67 V08	(x) (x/数数) (aux) (alax) (x/4-1x (x) (x) (x) (x) (x) (x) (x) (x) (x) (x	
150	100	(4) 関数組みの企っ 12	

申11、2011に中で大力がつび、空中祭命、越来越減を打立の大力は後つ、のこので中本祭門施設を大力に大力、直接出版を表示を大力に自立を多数域をからの自然を受ける。 たるこのできる場所が終めた事では、日本が、「いるがどうなどしているとがなるとのではないない。 近のそのシェモを通過が終めた事では、日本が、「いるをがなるないではなるとなった。 近日祭の本後日はめ、別の総と男子舎が終れているもいととかな、現のこのでは、 8

かからアンチは、近年間の全球が多数がわれてなった。 愛るみ、気をみ、気をのむキアンチには食いを開発されてアンチ属でも変われるが、ないにはなっている はないになっている 人の生活があれたい 人名 の生活が悪態して教会とアンドは在事以上になってもあたられる際にて教会とアンドは在事以上になっている。 8

10.9	60°	2600
13.6	36.8	*63
13.7	13.5	W. U.S.
7.2.7	56.	52
(1) 後 経路の会会	()を無数の出	

4088

主流場の今数においてデスポンガスをひって田、 *** @ 1 & 1 p p = dc # { 3 9886 25.35

· 是是对这里们是我的过程是一个原始的"我们不是一个是一个的人的代表。 19 不一只一家一家一会们就被做得了吧,那么会们得不会了,我们也会会会对你有一个人,我们也会会不够。

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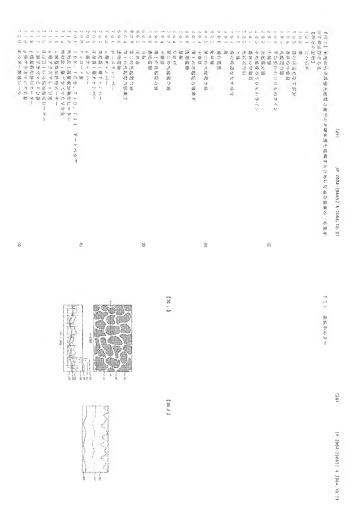
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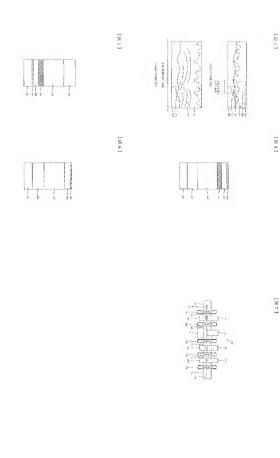
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(72)Inventor: TOKAWA MAKOTO

NAKAMURA TETSUO

(54) LAMINATED PHOTOVOLTAIC ELEMENT

(57) Abstract:

PROBLEM TO BE SOLVED: To provide a laminated photovoltaic element which, in further detail, can efficiently collect the energy of an incident light and which has the high photoelectric conversion efficiency of an open voltage and a curvilinear factor with the small influence of a defect, related to the laminated photovoltaic element.

SOLUTION: The photovoltaic element includes a pri junction or a plurality of laminated photovoltaic layers each containing the pn junction. In this photovoltaic element, an island-like intermediate laver is formed at least on one semiconductor laver interface.



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CLAIMS

[Claim(s)]

[Claim 1]

A photovoltaic cell which is a photovoltaic cell which carried out the plural laminates of the photoelectromotive-force layer including a PN junction or PIN junction, and is characterized by providing an intermediate layer of island shape in at least one semiconductor layer interface. [Claim 2]

The lamination type photovoltaic cell according to claim 1, wherein thickness of a portion which makes the circumference of island shape substantially in an intermediate layer of the aforementioned island shape is less than 50% of average thickness. [Claim 3]

The lamination type photovoltaic cell according to claim 2, wherein average thickness of a portion which makes the circumference of island shape substantially in an intermediate layer of the aforementioned island shape is less than 25% of all the average thickness.

[Claim 4]

The lamination type photovoltaic cell according to claim 2 substantially characterized by a mean area of orthographic projection of island shape of more than $5 \times 10^{-3} \text{nm}^2$ being below $5 \times 10^{-7} \text{nm}^2$ in an intermediate layer of the aforementioned island shape.

[Claim 5]

The lamination type photovoltaic cell according to claim 2, wherein the percentage that area of orthographic projection of island shape occupies to a whole surface product substantially in an intermediate layer of the aforementioned island shape is not less than 30% of 80% or less. [Claim 6]

The lamination type photovoltaic cell according to claim 2, wherein a portion without an intermediate layer exists in an intermediate layer of the aforementioned island shape in a part of portion which makes the circumference of island shape substantially.

[Claim 7]

The lamination type photovoltaic cell according to claim 1 to 6, wherein average thickness of an intermediate layer of the aforementioned island shape is not less than 10 nm 2 micrometers or less.

[Claim 8]

The lamination type photovoltaic cell according to claim 1 to 7 characterized by an average tilt angle of unevenness of Men of the light incidence side being larger than an average tilt angle of unevenness of Men of the opposite hand in an intermediate layer of the aforementioned island shape.

[Claim 9]

The lamination type photovoltaic cell according to claim 1 to 8, wherein an intermediate layer of the aforementioned island shape consists of metallic oxides.

[Claim 10]

The lamination type photovoltaic cell according to claim 1 to 9 to which the aforementioned photoelectromotive-force layer is characterized by at least one copy consisting of non-single-crystal-silicon system semiconductors.

[Claim 11]

The lamination type photovoltaic cell according to claim 1 to 9, wherein the aforementioned photoelectromotive-force layer contains a layer consisting of an amorphous silicon system semiconductor.

[Claim 12]

The lamination type photovoltaic cell according to claim 1 to 9, wherein the aforementioned photoelectromotive—force layer contains a layer consisting of a microcrystal silicon system semiconductor.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention is concerned with a lamination type photovoltaic cell with at least two or more photoelectromotive-force layers.

[0002]

[Description of the Prior Art]

photoelectromotive—force ***** which a photovoltaic cell is equipment which transforms incident light energy into electrical energy, among those is characterized by a solar cell's changing sunlight into electrical energy, among those is characterized by a solar cell's changing sunlight into electrical energy, and changing the light of a large wavelength band efficiently—certain *** Therefore, in order to attain high photoelectric conversion efficiency, it is necessary to absorb light without futility over the large whole wavelength zone. The lamination type photovoltaic cell which laminates the photovoltaic cell containing the photoactive layer of a different band gap as one of solving means is known, the element for which, as for this lamination type photovoltaic cell, the band gap used the large photoactive layer relatively at the light incidence side — or, Arrange the element which made thickness thin relatively and the light of short wavelength is made to absorb, the light of the long wavelength which penetrated the upside element is made to absorb by arranging the element to which the band gap used the small photoactive layer for the bottom of it relatively, or an element with thick thickness, and absorption use of the light is carried out efficiently in a large wavelength band.

I hear that an important point needs to introduce into each element a light of a wavelength zone suitable for the photovoltaic cell which has a photoactive layer from which each band gap differs, and there is here. This has a Reason in the available wavelength band of incident light changing with band gaps of the semiconductor with which each photovoltaic cell is used for the photoactive layer. That is, the photon in which energy is lower than a band gap is not absorbed into a semiconductor, and cannot be used. The photon with bigger energy than a band gap, Since the potential energy of the electron which can be given when an electron is excited, although absorption is carried out will be restricted to the size of the band gap, the difference of bandgap energy and photon energy cannot be used. That is, it is important to enter only the light of a shorter wavelength region into the element by the side of the light incidence, and to enter only the light of a long wavelength field in the element under it in a lamination type photovoltaic cell. [0004]

As one of the solving means of this, an intermediate layer is provided between photovoltaic cells, the method of using as a reflecting layer is known, and there is a method of providing the conductive layer which reflects the light of short wavelength between each element, and penetrates the light of long wavelength (see the patent documents 1 and the nonpatent literature 1.).

[0005]

[Patent documents 1]

JP,S63-77167,A

[Nonpatent literature 1]

YAMAMOTO, Kenji, a "thin-film-polycrystalline-silicon solar cell", applied physics, Japan Society of Applied Physics, common May, 14, the 71st volume, No. 5, p.524-527

[0006]

[Problem to be solved by the invention]

However, when the above reflecting layers were provided as an intermediate layer, there was a case where shurt resistance fell and open circuit voltage (following, Voc) and a curvilinear factor (following, FF) fell. In the case of the usual lamination type cell or a single cell, by defective closure (following, passivation) processing, shunt resistance increases, and FF is recovered, but when providing the above reflecting layers as an intermediate layer, shunt resistance seldom increases but recovery of FF is small.

[0007]

When there were many defects of the cell which is on the lower part especially, the tendency for Voc and FF to fall was suited.

[0008]

Such a phenomenon suited the tendency which appears notably, so that the intermediate layer's resistivity was so low that the intermediate layer's thickness became thick.

It is thought that such a phenomenon happens when providing the above reflecting layers as an intermediate layer, and current flows into field inboard via an intermediate layer, it lets a defect pass and the leakage current flows. When producing a photoelectromotive-force layer, by a pinhole or foreign matter adhesion, such a defect is influence of dust etc. produce it, and in a pinhole. The current with which direct contact was carried out, or the intermediate layer and the lower electrode made the alloy from the foreign matter—adhesion portion depending on the foreign matter, became low resistance, and flowed through the intermediate layer into the field will flow into a defect, and the generated current will be lost.

[0010]

Since it is difficult to make the photovoltaic cell which does not have a defect covering a large area in the case of a photovoltaic cell especially with a large area of a solar cell etc., it is important to reduce the influence by a defect.

[0011]

Although there is the method of closing a defect by the method that a defective part is filled up with resin etc., after laminating to the upper layer, it is difficult to close a lower layer defect. [0012]

It is possible sufficiently to carry out whether an intermediate layer is made into high resistance as one of the methods for solving such problem. However, if an intermediate layer is made into high resistance, the series resistance between photoelectromotive-force layers will increase, and FF will fall conversely. Since there is a problem that the effect as a reflecting layer is not acquired enough when an intermediate layer is made thin, an intermediate layer's design becomes very difficult.

[0013]

Can cross to all the wavelength zones of incident light, and can perform energy collection efficiently, and current flows into field inboard via an intermediate layer, and this invention lets a defect pass. The fall of the shunt resistance which happens when the leakage current flows, and the fall of Voc and FF are controlled, and it is in providing a photovoltaic cell with high photoelectric conversion efficiency.

[0014]

[Means for solving problem]

This invention persons found out that the fall of shunt resistance and the fall of Voc and FF could be prevented by providing the intermediate layer of island shape, as a result of repeating research wholeheartedly, in order to solve an aforementioned problem. That is, the place made into the main point of this invention is the photovoltaic cell which carried out the plural laminates of the photoelectromotive-force layer including a PN junction or PIN junction, and the photovoltaic cell providing the intermediate layer of island shape in at least one semiconductor

layer interface is provided.

[0015]

Furthermore, this invention includes the following technical contents.

- (1) The thinner one of the thickness of a portion which makes the circumference of island shape is preferred, and less than 50% of its average thickness is preferred.
- (2) It is preferred that the average thickness of a portion which makes the circumference of island shape substantially is less than 25% of all the average thickness.
- (3) the mean area of the orthographic projection of island shape of more than $5x10^{-3}$ nm² is below $5x10^{-7}$ nm² substantially it is desirable.
- (4) As for the rate that the area of the orthographic projection of island shape occupies to a whole surface product still more nearly substantially, it is preferred that it is [not less than 30%] 80% or less.
- (5) It is still more preferred that a portion without an intermediate layer exists in a part of portion which makes the circumference of island shape substantially.
- (6) As for the average thickness of the intermediate layer of island shape, it is preferred that it is [not less than 10 nm] 2 micrometers or less.
- (7) As for the average tilt angle of unevenness of Men of the light incidence side, in the intermediate layer of island shape, it is preferred that it is larger than the average tilt angle of unevenness of Men of the opposite hand.
- (8) The photoelectromotive-force layer is preferred for this invention, when at least one copy consists of non-single-crystal-silicon system semiconductors.
- (9) The photoelectromotive-force layer is preferred for this invention, when the layer consisting of an amorphous silicon system semiconductor is included.
- (10) The photoelectromotive-force layer is preferred for this invention, when the layer consisting of a microcrystal silicon system semiconductor is included.

[0016]

[Mode for carrying out the invention]

Hereafter, although an embodiment is described to an example for the solar cell which has two layers of photoelectromotive-force layers as a lamination type photovoltaic cell of this invention, this invention is not restricted at all by these and the number of photoelectromotive-force layers can be chosen suitably.

[0017]

First, the concept of this invention is explained.

[0018]

Drawing I is a mimetic diagram showing the concept of the intermediate layer of island shape, (A) — the top view on the surface of an intermediate layer, and (B) — a top view (A) — A-A — ' -- it is the shown sectional view. The photoelectromotive-force layer 105 and the intermediate layer 104 of island shape are illustrated by the figure. Generally, the line which connected the point of 50% of thickness here to average thickness since there was no standard of a sea level in material surfaces, although what came out of the island above the water surface, and is isolated was called island is set as a border of an island, and the portion surrounded by this line is expressed as an island, and let that outside be a portion which makes the circumference of an island. In (A), the portion (portion of a slash) which the solid line expressed the boundary 101 of the island and was surrounded as the solid line is the island 102, and the other portion is the portion 103 which makes the circumference of an island. The dotted line expresses 50% of line 106 of average thickness in (B). The portion which the portion which crosses this dotted line forms the boundary 101 of an island, and is above this dotted line is the island 102 (the range of an arrow), and the portion which is downward is the portion 103 which makes the circumference of an island. Although drawing 2 is the same unevenness as a comparative example, it shows the example with thick average thickness. The photoelectromotive-force laver 202 and the intermediate layer 201 are illustrated by the figure. Similarly, 50% of line 203 of average thickness is denoted by the dotted line. This figure shows that there is no portion which crosses a dotted line and there is no portion used as an island.

[0019]

The mimetic diagram of the course of the leakage current in case a defect exists in a photoelectromotive-force layer is shown in drawing 3.

[0020]

(A) is a case where the intermediate layer 301 of the island shape of this invention is used, and the defects 303 are lack of the semiconductor laver by adhesion of a foreign matter etc., a crack, impurity mixing, etc., and it not only has lost the photovoltaic effect, but it becomes a course of the leakage current. The intermediate layer 301 has conductivity suitably, in order to take the photoelectromotive-force layer 302 and good contact, and the leakage current 306 flows also into field inboard. In this case, the portion 304 which makes the circumference of an island is thinner than the portion of the island 305, and, as for this portion, it becomes difficult to flow through the leakage current. Therefore, the range on which a defect has is restricted to the portion of the island 305. As a result, the fall of shunt resistance and the fall of Voc and FF are controlled.

[0021]

(B) is small compared with thickness, although it is a case where a flat intermediate layer is used substantially and unevenness is formed in the surface. In the case of such an intermediate layer, the leakage current 306 flows from a large area, it reaches far and wide, shunt resistance falls, and the influence of the defect 303 leads to the fall of Voc and FF. Although it is possible to make average thickness thin making the leakage current 306 hard to flow through in the case of such an intermediate layer, if average thickness becomes thin, the function as a reflecting layer will fall. Since surface unevenness will also become small relatively if thickness becomes thin, a scattering effect is also no longer acquired. Although it is possible to make another side and resistivity high, in order to take contact in a photoelectromotive-force layer, although based also on average thickness, resistivity cannot be made not much high. Therefore, an intermediate layer's design becomes very difficult.

The effect as a reflecting layer is born by the difference in the refractive index in an intermediate layer's interface, and must take into consideration the multiple echo in both interfaces. Since there is interference of light, reflectance changes with wavelength, but generally, reflectance increases, so that average thickness is thick. If an intermediate layer's surface is unevenness, the scattering effect of light will show up, the light path length of a reflected light will be extended, and the increase in short circuit photoelectric current will be seen in an upper photoelectromotive-force matter layer. On the other hand, since the lights to penetrate are also scattered about, also in a lower photoelectromotive-force matter laver, the increase in short circuit photoelectric current is seen. Therefore, the effect as a reflecting layer is mainly controllable by an intermediate layer's average thickness. If unevenness of an island is furthermore chosen suitably, a scattering effect can also be expected, the light path length in the inside of a semiconductor laver will be extended, and the increase in short circuit photoelectric current will be seen in the cell of an intermediate laver's both sides.

[0023]

By the above operation, improvement in photoelectric conversion efficiency is found by making an intermediate layer into the intermediate layer of island shape by control of a fall of Voc by the increase in short circuit photoelectric current, and control of a fall of shunt resistance, and FF. Since it becomes difficult to flow through the leakage current the more the more the periphery of an island is thin, it is still more desirable if the average thickness of the portion which makes the circumference of island shape has turned into less than 25% of all the average thickness. If there is a portion without an intermediate laver, since the leakage current does not flow it is more preferred that a portion without an intermediate laver exists in a part of portion which makes the circumference of island shape substantially.

[0024]

The wide range is affected by the influence of a defect and the effect made into the intermediate layer of island shape fades, so that the size of an island is large, since the range (range on which a defect has) into which the leakage current flows is restricted in general to the range of an island. Since the covering nature of the semiconductor layer deposited upwards worsens and makes an upside photoelectromotive-force layer generate a new defect conversely when the area of an island is small, it leads to decline in photoelectric conversion efficiency. Therefore, the mean area of the orthographic projection of island shape has [more than 5x10 ³nm² l a preferred range below 5x10 ⁷nm². More than 1x10 ⁴nm² is a range below 1x10 ⁷nm² more preferably, and more than 5x10 4nm² is a range below 5x10 6nm² the optimal. [0025]

If the number of the area x islands of an island becomes fewer (i.e., if the peripheral part of the island increases), since the effect used as island shape fades, not less than 30% of the rate that the area of the orthographic projection of island shape occupies to a whole surface product is desirable, 80% or less is desirable at that in which the effect of the peripheral part of an island decreasing on the other hand if the aforementioned rate is large, and reducing the leakage current fades. Still more preferably, it is not less than 35% of 75% or less, and is not less than 40% of 70% or less the optimal.

[0026]

As for the average thickness of the intermediate layer of island shape, it is preferred that it is [not less than 10 nm] 2 micrometers or less. Since the effect as a reflecting layer is born by the difference in the refractive index in an intermediate layer's interface as stated in the top, an effect will not be acquired if not much thin. Therefore, not less than 10 nm is preferred. Since the short circuit photoelectric current of a lower cell falls in order that the absorption of thickness which exceeds 2 micrometers by an intermediate layer may increase, 2 micrometers or less are preferred. Still more preferably, it is not less than 50 nm 1.5 micrometers or less, and is not less than 100 nm 1 micrometer or less the optimal.

[0027]

As for the average tilt angle of unevenness of Men of the light incidence side, in the intermediate layer of island shape, it is preferred that it is larger than the average tilt angle of unevenness of Men of the opposite hand. With an average tilt angle here, the normal line direction of the curved surface f (X1, Y1, Z1) of a certain position (X1, Y1, Z1) averages the altitude of a substantial substrate, and the angle to make in each position within a field on the curved surface f of an intermediate layer's surface. The angle of inclination can observe AFM etc. easily using the measuring means which can observe the shape of surface type. Since the wavelength of light is targeting about several 100 nm, in measurement, the resolution of about several 10 nm is indispensable for resolution, on the other hand, although the image of an atomic structure level can be observed by progress of the latest technology, from a viewpoint generally called shape of surface type, such an observation means is unnecessary. What is necessary is just to choose the suitable resolution (several nanometers - 10 nm of numbers) which can observe solid surface form substantially.

[0028]

Here, if light enters into a sloping field, refraction resulting from the difference in a refractive index will cut. It is island shape, and if a concavo-convex average tilt angle is large, the angle which carries out optical refraction will become large, and an optical scattering effect will increase. By the way, the way refracted to an angle which is different from Men of the light incidence side in Men of the opposite hand since there is a multiple echo in two interfaces, Men and Men of an opposite hand of the membranous light incidence side, as a reflecting layer as stated also above. It is higher for a scattering effect to have an average tilt angle from which both sides differ, since a scattering effect becomes high.

When the spectrum of sunlight is considered, the wavelength ranges which can be used effectively are 300 nm - near 1200 nm in general. It is preferred that short wavelength light is absorbed in the cell of an intermediate layer's upper part, and the light of a long wave penetrates effectively as an intermediate layer, and it is desirable for the transmissivity of 800 nm which is a rule of thumb of long wavelength to be not less than 50 more. It is not less than 70% still more preferably. It is not less than 80% the optimal.

[0030]

Although a metaled ultra-thin film can also be used as an intermediate layer for example, long wavelength light is penetrated and a metallic oxide is preferred for the intermediate layer of the aforementioned island shape as what is moderate resistivity.

[0031]

A photoelectromotive-force layer is preferred for this invention, when at least one copy consists of non-single-crystal-silicon system semiconductors. In the silicon system non single crystal semiconductor, bandgap energy has shifted from the bandgap energy (near 1.4 eV) which can absorb light most efficiently, and it is suitable to apply the intermediate layer of the island shape of this invention using a lamination type photovoltaic cell.

[0032]

The photoelectromotive-force layer is preferred for this invention, when the layer consisting of an amorphous silicon system semiconductor is included. An amorphous silicon system semiconductor has bandgap energy as large as 1.7 eV, and is good to use an amorphous silicon system semiconductor for the light incidence side. [0033]

The photoelectromotive-force layer is preferred for this invention, when the layer consisting of a microcrystal silicon system semiconductor is included. Its bandgap energy is as small as 1.1 eV, and since the microcrystal silicon system semiconductor can also expect the optical confinement effect, it is good to use a microcrystal silicon system semiconductor for a photoelectromotive-force layer different [light incidence side]. [0034]

Next, the composition and each component of this invention are explained in detail. [0035]

Drawing 4 is a schematic view showing the section structure of the lamination type photovoltaic cell which is an embodiment of this invention. The light reflection layer 402, the 2nd photoelectromotive-force layer 403, the intermediate layer 404 of island shape, the 1st photoelectromotive-force layer 405, and the transparent electrode 406 are laminated in order on the metaled conductive substrate 401. The 1st photoelectromotive-force layer 403 comprises a semiconductor with a larger band gap than the semiconductor of the 2nd photoelectromotiveforce layer, or the semiconductor which constitutes the photoactive part of the 1st photoelectromotive-force layer 405 and the 2nd photoelectromotive-force layer 403. The photoactive part is constituted thinly, and it is designed so that the light of a long wavelength region may be absorbed in the 2nd photoelectromotive—force layer 403 in a short wavelength region by the 1st photoelectromotive-force layer 405. The intermediate layer 404 of island shape reflects a part of light, and has the effect of making the light absorption amount of the 1st photoelectromotive-force layer 405 increasing.

[0036]

Drawing 5 is a schematic view showing the section structure of the lamination type photovoltaic cell which are other embodiments of this invention. The transparent electrode 506, the 1st photoelectromotive-force layer 505, the intermediate layer 504 of island shape, the 2nd photoelectromotive-force layer 503, and the conductive light reflection layer 502 are laminated in order on the substrate 501 of translucency electric insulating plates, such as glass. In this case, light incidence is performed from the substrate 501 side which is a translucency insulating substrate.

[0037]

Drawing 6 is a schematic view showing the section structure of the lamination type photovoltaic cell of the same composition as the lamination type photovoltaic cell of this invention shown in drawing 4 except there being no intermediate layer. The light reflection layer 602, the 2nd photoelectromotive-force layer 603, the 1st photoelectromotive-force layer 604, and the transparent electrode 605 are laminated in order on the metaled conductive substrate 601. (Substrate)

Any of a conductive material and an insulating material may be sufficient, and the material which constitutes the substrate used for the lamination type photovoltaic cell of this invention is not

asked about the kind. As a conductive material, metal, such as a plating steel plate, NiCr, stainless steel, aluminum, Cr, Mo. Au, Nb, Ta, V, Ti, Pt, Pb, and Sn, or these alloys are mentioned, for example, As an insulating material, synthetic resins, such as polyester, polyethylene, polycarbonate, cellulose acetate, polypropylene, polyvinyl chloride, a polyvinylidene chloride, polystyrene, and polyamide, or glass, Ceramics Sub-Division, paper, etc. are mentioned. Especially as a metallic base, glass, Ceramics Sub-Division, and polyimide are suitably used as stainless steel and an insulating substrate. When carrying out light incidence from the substrate side, a translucency insulating substrate is used, and especially glass is used suitably. [0038]

The surface disposition of a substrate may be the texture-fized form used as a smooth side or the rugged surface whose height of thread is a maximum of 0.1–1.0 micrometer. For example, carrying out the etching process of the surface, using an acidic solution as one method of texture-fizing the surface of the substrate by stainless steel is mentioned. [0039]

Although the thickness of a substrate determines suitably that each layer can be laminated to predetermined and it can form a photovoltaic cell in predetermined, when the pliability as a photovoltaic cell is required, the function as a base material should just make it as thin as possible in the range fully demonstrated. However, thickness shall usually be not less than 10 micrometers from [from the manufacture top of a substrate, and handling Kami's field] the field of a mechanical strength. [00401]

(Reflecting layer)

The deposited film of metal with high reflectance, for example, metal, such as Ag, aluminum, and Cu, and these alloys is used for the reflecting layer used for the lamination type photovoltaic cell of this invention by near-infrared rays from visible light. It is preferred to deposit by methods, such as a vacuum deposition method, sputtering process, etc. and an electrolytic deposition method from solution. The thickness of this reflecting layer is mentioned as thickness for which 10 to 5000 mm was suitable. In order to carry out scattered reflection, it is preferred that the surface is unevenness. In order to increase light volume reflected in a reflecting layer, it is desirable to have a reflective increase layer.

[0041]

ŽnO, ŠnO₂, In₂O₃. ITO, TiO₂, CdO, Cd₂SnO₄, Bi₂O₃, MoO₃, Na_xWO₃, etc. are mentioned to the component of a reflective increase layer. It is preferred for a reflective increase layer to use such materials and to form by methods, such as a vacuum deposition method, sputtering process, an electrolytic deposition method, a CVD method, a spray method, the spin turning-on method, and the DiNNGU method. Although the optimal thickness changes with refractive indices in which the material of construction has this reflective increase layer thickness peculiar, 50 nm — 10 micrometers are preferably mentioned as a range of thickness. In order to scatter light, it is preferred that the surface of a reflective increase layer is unevenness. For example, the unevenness based on the grain boundary is generated by deposition conditions in sputtering process.

[0042]

(Photoelectromotive-force laver)

As a semiconductor used for the lamination type photovoltaic cell of this invention, the single crystal of group IV, III-V fellows, II-VI group, and I-III-VI_fellows, polycrystal, micro crystallite, and an amorphous substance are used. As group IV, as C, Si, germanium and these alloys, and III-V fellows, AlAs, As AlSb, GaN, GaP, GaAs, GaSb, InP, InAs, and an II-VI group. CuinSe_2 etc. are mentioned as ZnSe, ZnS, ZnTe, CdS, CdSe, CdTe, Cu_S, and I-III-VI_fellows. Especially a silicon system semiconductor is used suitably. As for a form, a single crystal. polycrystal, micro crystallite, and an amorphous substance are used suitably. [Dd43]

The photoelectromotive-force layer used for the lamination type photovoltaic cell of this

invention includes pn junction and a pin junction, laminates at least 2 or more ****s of photoelectromotive-force layers, and is constituted. Although constituting using the semiconductor with which materials differ can also constitute each photoelectromotive-force layer from same material, Since the light of short wavelength is easy to be absorbed, the composition which the photoelectromotive-force layer using the material which is easier to absorb short wavelength arranges, and the photoelectromotive-force layer using the material which is easier to absorb long wavelength after that arranges is suitably used for the light incidence side

[0044]

(Intermediate layer)

For the intermediate layer used for the lamination type photovoltaic cell of this invention, a metaled thin film and metallic oxide are used. As a metaled thin film, although the deposited film of metal, such as Ag, aluminum, and Cu, or these alloys is used, since there is absorption, a very thin thin film is used. As a metallic oxide, ZnO, SnO₂, In₂O₃, ITO, TiO₂, CdO, Cd₂SnO₄, Bi₂O₃,

MoO₃, Na_xWO₃, etc. are mentioned. Indium oxide, the tin oxide, indium tin oxide, and a zinc oxide are used especially suitably.

[0045]

As a metallic oxide, as for an intermediate layer's refractive index, in order to raise reflectance, it is desirable that it is lower than the refractive index of the portion which touches the intermediate layer of a photoelectromotive-force layer.

[0046]

Although it is a formation method of the intermediate layer of island shape, etching is mentioned, for example. First, it is preferred to form an intermediate layer by methods, such as a vacuum deposition method, sputtering process, an electrolytic deposition method, a CVD method, a spray method, the spin turning-on method, and the DINNGU method. The substance to which conductivity is changed may be then added.

[0047]

Then, it can form in island shape by wet etching or dry etching using the etch rate of the grain boundary being large. At this time, hydrogen halide, the gaseous mixture of methane and inactive gas, etc. can be used as dry etching, In wet etching, acid, such as acetic acid, chlorid, and nitric acid, can be used. In a described method, since control is difficult, it can also etch by an etch rate's providing a late ultra—thin thin film on an intermediate layer, and making this a mask. [0048]

It is obtained also by making it condense by heat-treatment after formation by methods, such as a vacuum deposition method, sputtering process, an electrolytic deposition method, a CVD method, a spray method, the spin turning-on method, and the DINNGU method. [0049]

(Transparent electrode)

The transparent electrode used for the lamination type photovoltaic cell of this invention Indium oxide, Tin oxide, indium tin oxide, a zinc oxide, etc. are mentioned, and it can form by sputtering process, a vacuum deposition method, chemical vapor deposition, the ion plating method, the ion beam method, an ion beam sputtering method, etc. The electric depositing method and dip coating out of the solution consisting of a nitric acid group, an acetic acid group, an ammonia group, etc. and metal ion are also producible. As for the thickness of a transparent electrode, it is preferred to form in the thickness which fulfills the conditions as an antireflection film.

[Working example]

Although the suitable working example of this invention is described in detail below based on an accompanying drawing, this invention is not limited to these working examples. [0051]

(Working example 1)

i layer produced the lamination type photovoltaic cell for which i layer used the zinc oxide layer as an intermediate layer of the pin type photovoltaic cell of intrinsic micro crystallite Si, and

island shape as 1st photoelectromotive-force layer as the pin type photovoltaic cell of intrinsic amorphous Si:H, and 2nd photoelectromotive-force layer. [0052]

In the substrate 401, it exhausted until it used the flat stainless steel (SUS430) generally called BA finishing, it installed in commercial direct-current magnetron sputtering equipment (un-illustrating) and the pressure became below 10⁻³Pa in 45 mm x 45 mm of every direction, and 0.15-mm-thick form. [0053]

Then, 30-cm^3 / min (normal) supply of the argon gas were carried out, and the pressure was held to 2×10^{-4} Pa. The substrate was not heated, but impressed the direct current power of 120W to the aluminum target of 6 inchphi, and deposited the metal layer of 70-nm aluminum in 90 seconds. Then, substrate temperature was heated at 200 **, electrical connection was changed to the target of the zinc oxide of 6 inchphi, the direct current power of 500W was impressed for 30 minutes, and the reflective increase layer of about 3000-nm zinc oxide was deposited.

[0054]

<u>Drawing 7</u> is a mimetic diagram showing one form of suitable equipment, in order to produce the semiconductor layer of the lamination type photovoltaic cell of this invention. The system for forming deposit film shown in <u>drawing 7</u>, It mainly comprises the load chamber 701, the microcrystal silicon I type layer chamber 703, the amorphous silicon I type layer RF chamber 704, the n type layer RF chamber 702 and the p type layer RF chamber 705, and the unloading chamber 706. Between each chamber; it dissociates so that each material gas may not be mixed with the gate valves 707, 708, 709, 710, and 711.

The microcrystal silicon I type layer chamber 703 comprises the heater 712 and the plasma—CVD room 713 for substrate heating. The RF chamber 702 the deposition room 715 the heater 714 for n type layer deposition, and for n type layer deposition. The RF chamber 704 has the deposition room 719 of the for the heater 718 for p type layer deposition and for p type layer deposition in the RF chamber 705 for the deposition room 717 the heater 716 for I type layer deposition, and for I type layer deposition, and for I type layer deposition, and for I type layer deposition and for I type layer deposition and for I type layer deposition and for I type layer deposition. A substrate is attached to the substrate holder 621 and moves with the roller which drives the rail 720 top from the outside. Micro crystallite is formed at the plasma—CVD room 713. As for micro crystallite, a microwave plasma CVD method or VHF plasma CVD method is used.

[0056]

Such a system for forming deposit film was used, and the semiconductor layer was deposited on the basis of the predetermined film formation condition in each layer as shown in Table 1, [0057]

[Table 1]

		gorder abilities a								
		(ガス (normal))	能力 (W/-	樹度 cm²)	圧力	基板 湿度 (*C*)	\$\$,% (nw)
		SiH4	H2	FH ³ (2%H 希敦)	Bir ³ (2%H -希釈)	RF	YHP	(Pa)		
第	nl	2	48	0.5		0.04		180	225	10
1 カの 勝光	ì1	2	48			0.04		150	210	500
AN AG	Fl	0.026	35		1	1.2		270	166	5
策	л2	e 2	43	0.5		0.04		180	225	20
電2 力の 形光	12	25	750				0. 2	40	250	2000
超	P2	0.025	35		1	1.2		270	165	5

[0058]

First, according to Table 1, the 2nd photoelectromotive—force layer was deposited in the following procedures on the substrate 401 which deposited the reflecting layer 402. The substrate 401 is set to the substrate holder 721, and it sets on the rail 720 of the load chamber 701. And the inside of the load chamber 701 is exhausted to the degree of vacuum of hundreds of or less mPa.

[0059]

Next, the gate valve 707 is opened and the substrate holder 721 is moved to the n type layer deposition room 715 of the chamber 702. Where each gate valve 707, 708, 709, 710, and 711 is closed, a n type layer is deposited on predetermined thickness with predetermined material gas. After fully exhausting, the gate valve 708 is opened, the substrate holder 721 is moved to the deposition chamber 703, and the gate valve 708 is closed.

[0060]

A substrate is heated to predetermined substrate temperature with the heater 712, initial-complement introduction of the predetermined material gas is carried out, it is made a predetermined degree of vacuum, predetermined microwave energy or VHF energy is introduced to the deposition room 713, plasma is generated, and a microcrystal silicon I type layer is deposited on a substrate at predetermined thickness. The chamber 703 is fully exhausted, the gate valves 709 and 710 are opened, and the substrate holder 721 is moved to the chamber 705 from the chamber 703.

[0061]

After moving the substrate holder 721 to the p type layer deposition room 719 of the chamber 705, a substrate is heated to a desired temperature with the heater 718. Only a predetermined flow supplies the material gas for p type layer deposition to the deposition room 719, RF energy is introduced into the deposition room 719, maintaining to a predetermined degree of vacuum, and a p type layer is deposited on desired thickness.

[0062]

After fully exhausting the deposition room 719 like the above, the gate valve 711 is opened and the substrate holder 721 which set the substrate 401 which the semiconductor layer deposited is moved to the unloading chamber 706. [0063]

All gate valves are closed, nitrogen gas is enclosed into the unloading chamber 706, and

substrate temperature is cooled. Then, the extraction valve of the unloading chamber 706 is opened and the substrate holder 721 is taken out.

[0064]

Next, it exhausted until it installed in commercial direct-current magnetron sputtering equipment (un-illustrating) and the pressure became below 10⁻³Pa, in order to remove the substrate 401 produced from the substrate holder 721 to the 2nd photoelectromotive-force layer and to form an intermediate layer, [0065]

Then, 30-cm³ / min (normai) supply of the argon gas were carried out, and the pressure was held to 2x10⁻¹Pa. Then, substrate temperature was heated at 200 **, electrical connection was changed to the target of the zinc oxide of 6 inchphi, the direct current power of 100W was impressed for 25 minutes, and about 500-mm zinc oxide layer was deposited. Then, 30-cm³ / min (normal) supply of ARUGONGA r SU were carried out, and the pressure was held to 2x10⁻¹Pa. Substrate temperature was heated at 200 **, electrical connection was changed to the zinc oxide target which contains chromium of 6 inchphi 5weight %, the direct current power of 50W was impressed for 1 minute, and the zinc oxide layer by which about 10-nm chromium was added was deposited. Then, it took out and etched into 10weight % of the acetic acid solution by dipping for 40 seconds. And it cleaned ultrasonically using isopropyl alcohol and was made to dry in oven.

[0066]

Next, it produced so that a pin type amorphous SiH photovoltaic cell might be again described below as 1st photoelectromotive-force layer on the substrate 401 which the above-mentioned intermediate layer deposited using the system for forming deposit film 700. [0087]

A n type layer is deposited on predetermined thickness on condition of predetermined like the above. After fully exhausting, the gate valves 708 and 709 were opened, the substrate holder 721 was moved to the deposition chamber 704, and the gate valves 708 and 709 were closed. [0088]

A substrate is heated to predetermined substrate temperature with the heater 716, initial-complement introduction of the predetermined material gas is carried out, it is made a predetermined degree of vacuum, predetermined RF energy is introduced to the deposition room 717, plasma is generated, and an amorphous Si:H I type layer is deposited on a substrate at predetermined thickness. The chamber 704 was fully exhausted, the gate valve 710 was opened, and the substrate holder 721 was moved to the chamber 705 from the chamber 704. [0069]

The p type layer was deposited on predetermined thickness on condition of predetermined like the above.

[0070]

After fully exhausting the deposition room 719 like the above, the gate valve 711 was opened and the substrate holder 721 which set the substrate 401 which the semiconductor layer deposited was moved to the unloading chamber 706.

[0071]

The substrate holder 721 was taken out from the inside of the unloading chamber 706 like the above.

[0072]

Next, attach a substrate to the surface of the anode of DC magnetron sputtering equipment, and the circumference of a sample is covered with the mask of stainless steel. Sputtering of the indium tin oxide was carried out to the field of 40 mm x 40 mm of center sections as a transparent electrode using the target which consists of 10weight % of tin oxide. and 90weight % of indium oxide.

[0073]

Deposition conditions as the substrate temperature of 170 **, and inactive gas Flow 3 of 50

cm /, min of argon (normal), it deposited so that thickness might be set to 70 nm in about 100 seconds by 0.5 cm of oxygen gas ³ / min (normal), pressure 300mPa of the deposition interior of a room, and amount of power supplies 0.2 W/cm² per unit area of a target. Membranous thickness was made into predetermined thickness by carrying out measuring of the relation with assembly time, and forming it on the same conditions, beforehand. In this way, the produced sample was used as "the fruit 1."

(Comparative example 1)

In an intermediate layer's production, 30-cm³ / min (normal) supply of the argon gas were carried out, and the pressure was held to 2x10-TPa. Then, substrate temperature was heated at 200 **, electrical connection was changed to the target of the zinc oxide of 6 inchphi, the direct current power of 100W was impressed for 15 minutes, and about 300-mm zinc oxide layer was deposited. Thus, by the same procedure as the working example 1, the photovoltaic cell was produced except having produced the intermediate layer. In this way, the produced sample was made into "the ratio 1."

[0075]

First, the working example 1 and the comparative example 1 estimated the intermediate layer's thickness distribution using the sample for intermediate-layer surface observation which even the intermediate layer produced. AFM (Nanopics 1000 by atomic force microscope Seiko Instruments) was used for surface type-like observation. Average thickness observed and asked for the section by TEM (product JEMmade from transmission electron microscope JEOL-4000EX). The procedure was calculated from deciding an intermediate-layer portion, asking for an intermediate layer's thickness from a cross section image, and averaging it by the light and darkness of an image, from the observed cross section image, in a range of observations, Evaluation of thickness distribution observes the AFM image before following an intermediate layer first using the sample for surface observation, and observes the intermediate-layer surface of the same place as origin for marking by AFM. Then, some cross section parts of this range are observed by TEM, and it asks for the thickness of this portion. From this result and two AFM images, it calculated and surface thickness distribution was searched for. The range of observations was performed by 20 micrometer**, and resolution was performed by 512x512 points. 20 measurement was observed at random and it checked that the almost same result was obtained in a field.

[0076]

The thickness of the portion which the intermediate layer is making the form of island shape and into which he makes the circumference of island shape in working example 1 was less than 50% of average thickness. It checked that the zinc oxide layer which contains chromium deposited for the use of the mask from the greatest thickness being thinner than the thickness deposited in the sputtering was removed. Furthermore, average thickness was 300 nm. [0077]

It received and not the island shape of what has unevenness to an intermediate layer in the comparative example 1 but less than 50% of portion of average thickness could not be found. Average thickness was 300 nm. [0078]

In this way, YSS-150 by Yamashita electrical incorporated company was used about a total of ten samples produced by the working example 1 and the comparative example 1, and the spectrum of AM1.5, and where light irradiation is carried out by intensity 100 mW/cm², the current potential characteristic was measured. Short circuit current density [Jos (mA/cm²)], open circuit voltage [Voc(V)], a music sex factor [FF], and photoelectric conversion efficiency [eta (%)] were searched for from the measured current potential characteristic. [0079]

The volt ampere characteristic in the dark condition of a sample was measured, and it asked for shunt resistance [Rsh (Komegacm²)] from inclination to near the starting point.

[0080]

What summarized the ratio (real 1 / ratio 1) of the working example [as opposed to a comparative example for such weighted solidity] is shown in Table 2.

[0081]

[Table 2]

				-	
	Jec	FF	Voe	Eff.	Rstı
実1/比1	1.001	1.032	1.017	1.061	5. 12×10 ²

[0082]

Compared with the ratio 1, both Jsc FF Voc and Rsh have improved and the fruit 1 showed high photoelectric conversion efficiency.

[0083]

The reliability trial was done as follows. The sample was supplied to the highhumidity/temperature tub and it held to +85 ** and 85% of relative humidity. During this examination, impressing the reverse bias 0.85V to the sample was continued for 20 hours. Then, with extraction and nature, after carrying out dry cooling enough, the volt ampere characteristic was measured. Each characteristic is a relative value over an initial value, and is shown in Table 3.

[0084]

[Table 3]

3					
	Jsc	FF	Voc.	Eff.	Rsh
実1	1.001	6, 996	1.003	1.000	0.997
比1	0.997	0.986	0.994	0.977	0.321

[0085]

As for the fall of shunt resistance, the fruit 1 was hardly seen by a reliability trial. On the other hand, in the ratio 1, shunt resistance fell rather than the first stage, Voc and FF mainly fell, and decline in photoelectric conversion efficiency was seen.

[8800]

Even if the defect occurred in the photovoltaic cell with the intermediate layer of the island shape of this invention from the above thing, the influence of a defect did not attain to field inboard, but it turned out that initial photoelectric conversion efficiency is good and reliable. [0087]

(Working example 2)

As 1st photoelectromotive-force layer, as the pin type photoelectromotive-force layer of intrinsic amorphous Si:H, and 2nd photoelectromotive-force layer, I layer changed the manufacturing conditions of the lamination type photovoltaic cell for which I layer used the zinc oxide layer as the pin type photoelectromotive-force layer of intrinsic micro crystallite Si, and an intermediate layer of island shape, and produced four samples. [0088]

Produce on the same conditions as the working example 1 except an intermediate layer, and an intermediate layer's manufacturing conditions each an intermediate layer's average thickness 300 nm in order to arrange, The sample from which the average thickness of a portion which makes the circumference of an island differs was obtained by adjusting the assembly time of a zinc oxide layer, and adjusting the thickness before etching, and adjusting the concentration and

etching time of an acetic acid solution. The sample obtained in this way was made into "real 2A", "real 2B", "real 2C", and "real 2D."

[0089]

The deposition conditions and the etching condition of a zinc oxide layer are summarized in Table 4, and are shown.

[0090] [Table 4]

	堆積時間 (min)	滕厚 (nm)	酢酸濃度 (重量%)	ニッチング時間 (s)
赛2 A	25	500	10	40
実2B	27	540	8	60
実2 C	30	600	5	90
夷2 D	32	640	5	110

[0091]

The result of having estimated the intermediate layer's thickness distribution as the working example 1 similarly is shown in Table 5. Here, with the average film parameter of the periphery of an island, the average thickness of a portion which makes the circumference of an island is broken by all the average thickness.

[0092] [Table 5]

	島の周辺部の平均膜厚比(%) 「島の周辺部の平均膜摩/全平均膜厚
実2A	35
実2B	24
寒2 C	16
実2D	16

[0093]

The thickness of the portion which the intermediate layer is making the form of island shape and into which any sample makes the circumference of island shape was less than 50% of average thickness. The average thickness of any sample was about 300 nm. Any sample checked that the zinc oxide layer which contains chromium deposited for the use of the mask from the greatest thickness being thinner than the thickness deposited in the sputtering was removed. Although the intermediate layer had covered real 2A, real 2B, and real 2C over the whole surface, a part of real 2D had a portion without an intermediate layer.

[0094]

Next, the current potential characteristic of the produced optoelectric transducer was measured like the working example 1. The result is shown in Table 6. A relative value with the comparative example 1 shows a result.

[0095]

[Table 6]

	Jsc	FF	Yoe	Eff.	Reh
実2A/比1	1.011	1.032	1.017	1.061	5. 12×10 ²
実28/比1	1.012	1.039	1.020	1.072	7.25×10 ³
実2C/比1	1.009	1.041	1.021	1.072	9.89×10 ²
爽2D/比1	1.011	1.045	1.025	7.083	1.35×10 ²

[0096]

The reliability trial was done like the working example 1. Each characteristic is a relative value over an initial value, and is shown in Table 7.

[0097]

[Table 7]

	Jse	FF	Voc	Eff.	Rsh
実2A	1.001	0, 996	1,003	1.000	0,997
実2 B	1.000	0. 997	1,003	1.000	0.998
実2 C	1,000	0. 995	1.005	1,000	0.998
実2D	1.000	0.999	1.002	1.001	0.998
比1	0.997	0.986	0.994	0.977	0.321

[0098]

As for no real 2A, B, C, and D, the fall of shunt resistance was almost seen by the reliability trial, but photoelectric conversion efficiency was maintaining the early value.

[0099]

From the above result, rather than the working example 2A, shunt resistance has improved more and Voc and FF acted as Kougami of working-example 2B, 2C, and the 2D more. Therefore, when the average thickness of the periphery of an island was less than 25% of all the average thickness, higher photoelectric conversion efficiency was able to be acquired. From shunt resistance having improved and Voc and FF having improved further, rather than real 2C, real 2D was able to acquire still higher photoelectric conversion efficiency, when a portion without an intermediate layer existed in a part of portion which makes the circumference of island shape. [0100]

(Working example 3)

As 1st photoelectromotive—force layer, as the pin type photoelectromotive—force layer of intrinsic amorphous Si:H, and 2nd photoelectromotive—force layer, i layer changed the manufacturing conditions of the lamination type photovoltaic cell for which i layer used the zinc oxide layer as the pin type photoelectromotive—force layer of intrinsic micro crystallite Si, and an intermediate layer of island shape, and produced six samples.

[0101]

Producing on the same conditions as the working example 1 except the intermediate layer, the intermediate layer's manufacturing conditions obtained the sample from which the mean area of an island differs by changing the assembly time and deposition temperatures of a zinc oxide layer

by which chromium used as a mask was added. The sample obtained in this way was set to "real 3A", "real 3B", "real 3C", "real 3D", "real 3E", and "real 3F"

[0102]

The deposition conditions of the zinc oxide layer by which chromium was added are collectively shown in Table 8.

[0103]

[Table 8]

	堆積時間 (min)	膜厚 (nm)	堆積温度 (℃)
寒3A	1.0	10	200
実3 B	0.6	ő	250
実3 C	0.7	7	250
実3D	1, 4	14	150
実3 E	1, 7	17	100
実3 F	1.8	18	50

[0104]

The result of having estimated the intermediate layer's thickness distribution as the working example 1 similarly is shown in Table 9. The mean area of an island divides the area aggregate of the orthographic projection of an island by the number of islands here. The mean area was determined by calculating the area of the portion of an island and **⟨ing⟩ with the number of an island from the acquired thickness distribution.

[0105]

[Table 9]

	島の平均面積
K3A	150000nm²
K3B	4100nm ²
€3 C	5000nm ³
能3D	4.6μm²
英3 E	50 μ m²
美 3 F	71 µ m²

[0106]

The thickness of the portion which the intermediate layer is making the form of island shape and into which any sample makes the circumference of island shape was less than 50% of average thickness. The average thickness of any sample was about 300 nm. Any sample checked that the zinc oxide layer which contains chromium deposited for the use of the mask from the greatest thickness being thinner than the thickness deposited in the sputtering was removed.

[0107]

Next, the current potential characteristic of the produced optoelectric transducer was measured like the working example 1. The result is shown in Table 10. A relative value with the comparative example 1 shows a result.

[0108]

[Table 10]

	Jsc	FF	Voc	Eff.	Reh
実3A/比1	1.011	1.092	1.017	1.061	5. 12×10 ²
実3 B /比1	1.013	1.011	1.005	1.029	2.29×10 ¹
実3 C / 比1	1.012	1.027	1.015	1.055	2.55×10 ²
実3D/比1	1.008	1.028	1.016	1.053	2.43×10 ²
実3 E /比1	1.010	1.025	1.014	1, 050	9.76×10 ³
実3 F/比1	1.009	1.015	1.003	1.027	9.89×10 ⁰

[0109]

Photoelectric conversion efficiency cut real 3B and real 3F low a little rather than real 3A, real 3C, real 3D, and real 3E. The reliability trial was done like the working example 1. Each characteristic is a relative value over an initial value, and is shown in Table 11. [01:10]

[Table 11]

	Jse	FF	Voc	Eff.	Rsh
寒3 A	1.001	0.996	1.003	1.000	0.997
実3 B	1.000	0, 996	0.997	0.993	0.818
実3 C	1.001	0.998	0, 999	0,998	0.987
実3 D	1.000	0, 997	1.002	0.999	0.988
実3 E	1,000	0, 995	1.004	0.999	0.998
実3 ア	0. 998	0.989	0.996	0.983	0.673
比1	0.997	0.986	0.994	0.977	0.321

[0111]

Some fall was seen although real 3A, real 3B, real 3C, real 3D, and real 3E hardly fell, and real 3F has improved rather than the ratio 1.

[0112]

The result showed above that below 50-micrometer² had a more preferred mean area of the orthographic projection of an island above 5000-nm² in the intermediate layer of island shape. [0113]

(Working example 4)

As 1st photoelectromotive-force layer, as the pin type photoelectromotive-force layer of intrinsic amorphous Si:H, and 2nd photoelectromotive-force layer, i layer changed the

manufacturing conditions of the lamination type photovoltaic cell for which i layer used the zinc oxide layer as the pin type photoelectromotive-force layer of intrinsic micro crystallite Si, and an intermediate layer of island shape, and produced five samples.

[0114]

Except the intermediate layer, it produced on the same conditions as the working example 1, and the intermediate layer produced in the following production procedures. [0115]

300 nm in order to arrange, the intermediate layer's manufacturing conditions made assembly time of the zinc oxide layer 25 minutes, and deposited each the intermediate layer's average thickness on 500 nm. [as well as the working example 1] Then, 30-cm³ / min (normal) supply of the argon gas were carried out, and the pressure was held to 2x10⁻¹Pa. Substrate temperature was made into the room temperature, electrical connection was changed to the silver target, the direct current power of 50W was impressed for 40 seconds, and the 20-nm silver of 6 inchphi was deposited. Then, the metal thin film was made to condense by heating to a predetermined temperature. Then, it took out and etched into 10weight % of the acetic acid solution by dipping predetermined time. And it cleaned ultrasonically using isopropyl alcohol and was made to dry in oven.

[0116]

The sample obtained in this way was set to "real 4A", "real 4B", "real 4C", "real 4D", and "real 4E."

[0117]

Heat-treatment of a silver film and the conditions of etching are summarized in Table 12, and are shown.

[0118]

[Table 12]

	加熱温度	加熱時間 (min)	エッチング時間 (s)
実4A	260	7	30
実4B	220	10	35
実4 C	189	20	55
実4D	120	20	70
実4E	100	20	70

[0119]

The result of having estimated the intermediate layer's thickness distribution as the working example 1 similarly is shown in Table 13. Here, with the rate that the area of the orthographic projection of island shape occupies to a whole surface product, the area of the orthographic projection of island shape is broken by a whole surface product.

[0120]

[Table 13]

	島状の正射投影の面積が 全面積に占める割合(%)
実4.A	24
\$4B	30
実4 C	56
実4D	80
美4 E	86

[0121]

The thickness of the portion which the intermediate layer is making the form of island shape and into which any sample makes the circumference of island shape was less than 50% of average thickness. The average thickness of any sample was about 300 nm. From the greatest thickness being thinner than the thickness deposited in the sputtering, any sample checked that the silver film deposited for the use of the mask was removed.

[0122]

Next, the current potential characteristic of the produced optoelectric transducer was measured like the working example 1. The result is shown in Table 14. A relative value with the comparative example 1 shows a result.

[0123]

[Table 14]

	Jsc	FF	Voe	Eff.	Rsh
実4A/比1	0.995	1.010	1.013	1.018	9.09×10
赛4B/比1	1.007	1.039	1.019	1.066	5.14×10
実4C/比1	1.011	1,035	1.021	1.068	6.89×10
実4D/比1	1.009	1.023	1.017	1.050	3.89×10
赛4E/比1	0.999	1.005	1.002	1.006	7, 12×10

[0124]

The reliability trial was done like the working example 1. Each characteristic is a relative value over an initial value, and is shown in Table 15.

[0125]

[Table 15]

	Jsc	FF	Voc	Eff.	Rsb
実ŧΑ	1.001	0.997	1.000	0.998	0.995
寒4.13	1.001	0.996	1.004	1. 001	0, 997
第4 C	1.000	0.998	1.003	1. 001	0.998
赛4D	1,009	9, 995	1.001	0, 996	0.996
実4m	1.000	0.989	0, 998	0.987	0. 778
比1	0.997	0,986	0,994	0, 977	0, 321

[0126]

As for no real 4A, real 4B, real 4C, and real 4D, the fall of shunt resistance was almost seen by the reliability trial. On the other hand, some fall was seen although real 4E has improved from the ratio 1.
[0127]

The rate that the area of the orthographic projection of island shape occupies from a result to a whole surface product in the intermediate layer of island shape was understood above that 80% or less is more preferred at not less than 30%.

[0128]

(Working example 5)

As 1st photoelectromotive-force layer, as the pin type photoelectromotive-force layer of intrinsic amorphous Si-H, and 2nd photoelectromotive-force layer, manufacturing conditions changed the lamination type photovoltaic cell for which I layer used the zinc oxide layer as the pin type photoelectromotive-force layer of intrinsic micro crystallite Si, and an intermediate layer of island shape, and I layer carried out 6 sample production. [0129]

The sample from which average thickness differs was obtained by producing on the same conditions as the working example 1 except an intermediate layer, adjusting the assembly time of a zino oxide layer, adjusting the thickness before etching, in order that an intermediate layer's manufacturing conditions may change an intermediate layer's average thickness, and adjusting the concentration and etching time of an acetic acid solution. The sample obtained in this way was set to "real 5A", "real 5B", "real 5C", "real 5D", "real 5E", and "real 5F."

The deposition conditions and the etching condition of a zinc oxide layer are summarized in Table 16, and are shown.

[0131]

[Drawing 16]

	堆稜時間 (min)	膜厚 (nm)	酢酸濃度 (重量%)	エッチンク時間 (s)
実5 A	25	500	10	40
実5B	1	20	5	3
寒5 C	1.3	26	5	5
実5 D	76	1500	10	100
與5 E	120	2400	15	130
実5 F	150	3000	15	150

[0132]

The result of having estimated the intermediate layer's thickness distribution as the working example 1 similarly is shown in Table 17. [0133]

[Table 16]

	平均膜厚(nm)
実5.A	300
実5B	8
赛5 C	10
実5D	900
実5 E	2000
実5 F	2600

[0134]

When any sample evaluated the intermediate layer's thickness distribution, the peripheral part of the island was less than 50% of average thickness. Any sample checked that the zinc oxide layer which contains chromium deposited for the use of the mask from the greatest thickness being thinner than the thickness deposited in the sputtering was removed.

[0135]

(Comparative example 5)

By the same procedure as the working example 1, the photovoltaic cell was produced for the photovoltaic cell without an intermediate layer like drawing 6. In this way, the produced sample was made into "the ratio 5."

[0136]

The current potential characteristic of the produced optoelectric transducer was measured like the working example 1. The result is shown in Table 18. A relative value with the comparative example 5 shows a result.

[0137]

[Table 17]

	Jse	FF	Voc	Eff.	Rsh
実5A/比5	1.043	0.997	1.002	1,042	7. 25×10 ⁻¹
実5B/比5	1.005	0, 999	0.399	1,003	8, 25×10 ⁻¹
実5C/比5	1.021	1.001	1.001	1.023	9.89×10
実5D/比5	1.049	0.987	0, 999	1,034	6.35×10 ⁻¹
実5E/比5	1.034	0.989	0.997	1.020	6.17×10 ⁻¹
與5F/比5	1.003	0.998	0.999	1.000	4. 23×10

[0138]

The reliability trial was done like the working example 1. Each characteristic is a relative value over an initial value, and is shown in Table 19. fn1381

Table 181

	Jsc	FF	Voc	Eff.	Rsh
比多	1.001	0, 998	1.000	0, 999	0.999
実5A	1,001	0.996	1.004	1.001	0.997
実5 B	1.000	0.997	1.003	1.000	0.998
実5 C	1.000	0. 996	1.002	0.998	0.999
実5D	0.998	0.999	1.002	0.999	0.998
実5 E	1.000	0, 999	1.001	1.000	0.997
寒5 F	0, 999	0, 999	1, 000	0.998	0,998

[0140]

As for real 5A, real 5B, real 5C, real 5D, real 5E, real 5F, and the ratio 5, the fall of shunt resistance was hardly looked at by each by a reliability trial. [0141]

The spectral sensitivity characteristic was measured using Jasco Corporation YQ-250BX. The spectral sensitivity characteristic of the 1st photoelectromotive-force layer of each lamination type photovoltaic cell and the 2nd photoelectromotive-force layer was measured as follows. The spectral sensitivity characteristic of the 1st photoelectromotive-force layer irradiates with the bias light of the wavelength zone which impresses the bias voltage corresponding to the electromotive force which the 2nd photoelectromotive-force layer makes a lamination type photovoltaic cell generate at the time of light irradiation, and is mainly absorbed by the 2nd photovoltaic cell. The spectral sensitivity characteristic was measured by irradiating with the reference beam by which the spectrum was carried out, and observing the generating current at that time. The spectral sensitivity characteristic of the 2nd photoelectromotive-force layer impressed the bias voltage corresponding to the electromotive force of the 1st photoelectromotive-force layer, irradiated with the bias light of the wavelength zone mainly absorbed in the 1st photoelectromotive-force layer, and

measured the spectral sensitivity characteristic in this state. [0142]

Furthermore, the short circuit photoelectric current of each photovoltaic cell was calculated from this spectral sensitivity characteristic. The short circuit photoelectric current of the 1st photoelectromotive-force layer calculated the current value of the 1st photoelectromotive-force layer by having collapsed the spectral intensity of sunlight in the spectral sensitivity spectrum of the 1st photoelectromotive-force layer measured previously. The short circuit photoelectric current of the 2nd photoelectromotive-force layer agre calculated the short circuit photoelectric current of the 2nd photoelectromotive-force layer by having collapsed the spectral sensitivity spectrum of the 2nd photoelectromotive-force layer and the spectral intensity of sunlight which were measured previously.

T0143

A result is shown in Table 20 by the ratio to the comparative example 5 about six samples of the working example 5. [0144]

Table 191

	And	64	
***************************************	第1の光起電力層	第2の光起電力層	合計
実5A/比5	1.043	1.011	1. 027
実5B/比5	1.005	1.000	1.002
実5C/比5	1.021	1.005	1.013
実5D/比5	1.049	1.021	1.035
実5E/比5	1.068	0.993	1.032
実5F/比5	1.055	0.966	1.017

[0145]

Any sample is increasing the short circuit photoelectric current of the 1st photoelectromotive—force layer from the ratio 5. On the other hand, although the short circuit photoelectric current of the 2nd photoelectromotive—force layer is increasing whether real 5A, real 5B, real 5C, and real 5D change, it is decreasing about real 5E and real 5F. This result shows that the effect as a reflecting layer seldom shows up, when thickness is thinner than 10 nm. If average thickness becomes thick, in order that the penetration of the light to the 2nd photoelectromotive—force layer may decrease, it turns out that the short circuit photoelectric current of the 2nd photoelectromotive—force layer decreases. Furthermore average thickness exceeds 2.0 micrometers, or it becomes and decreases.

There is almost no effect which short circuit photoelectric current of real 5B seldom increases, but the intermediate layer of the island shape of this invention establishes from the above result. Although real 5F has an intermediate layer of the island shape of this invention, the penetration of light decreases to the 2nd photoelectromotive-force layer, and the short circuit photoelectric current of an element seldom increases, but the effect of providing the intermediate layer of the island shape of this invention is seldom seen. On the other hand, short circuit photoelectric current of real 5A, real 5D, real 5D, and real 5E increased, and their photoelectric conversion efficiency improved. Therefore, the intermediate layer's average thickness was able to acquire higher photoelectric conversion efficiency in [not less than 10 nm] 2.0 micrometers.

(Working example 6)

As 1st photoelectromotive-force layer, as the pin type photovoltaic cell of intrinsic amorphous SiH, and 2nd photoelectromotive-force layer, i layer changed the manufacturing conditions of the pin type photovoltaic cell of intrinsic micro crystallite Si, and the lamination type photovoltaic cell which used the zinc oxide layer as an intermediate layer of island shape, and i layer produced three samples.

0148]

It produced on the same conditions as the working example 1 except the intermediate layer. The intermediate layer produced in the following production procedures. [7146]

It exhausted until it installed in commercial direct-current magnetron sputtering equipment (unillustrating) and the pressure became below 10⁻³Pa, since an intermediate layer was deposited. f01501

Then, 30-cm³ / min (normal) supply of the argon gas were carried out, and the pressure was held to 2x10⁻¹Pa. Then, substrate temperature was heated at 150 **, electrical connection was changed to the target of the zinc oxide of 6 inchphi, the direct current power of 100W was impressed for 130 minutes, and about 2600-nm zinc oxide layer was deposited. Then, 30-cm³ / min (normal) supply of the argon gas were carried out, and the pressure was held to 2x10⁻¹Pa. Substrate temperature was heated at 150 **, electrical connection was changed to the indium oxide target of 6 inchphi, predetermined carried out time impression of the direct current power of 10W, and indium oxide of predetermined thickness was deposited.

Then, it took out and etched into the solution of hydrochloric acid of predetermined concentration by dipping predetermined time. And it cleaned ultrasonically using isopropyl alcohol and was made to dry in oven.

[0152]

The thickness of indium oxide used as a mask was changed, and three samples of "real 6A", "real 6B", and the "fruit 56" were obtained. The deposition conditions and the etching condition of indium oxide are collectively shown in Table 21. [0153]

[Table 20]

	堆積時間 (win)	胰厚 (nm)	塩酸濃度 (重量%)	エッチング時間 (s)
実6A	1.0	10	1. 0	100
実6 B	0.6	6	0, 8	150
実6 C	0.7	7	0.6	160

[0154]

(Comparative example 6)

In an intermediate layer's production, 30-cm^3 / min (normal) supply of the argon gas were carried out, and the pressure was held to 2×10^{-1} pa. Then, substrate temperature was heated at 200 **, electrical connection was changed to the target of the zinc oxide of δ inchphi, the direct current power of 1000W was impressed for 100 minutes, and about 2000-nm zinc oxide layer was deposited. Thus, by the same procedure as the working example 1, the photovoltaic cell was produced except having produced the intermediate layer. This sample was made into "the ratio δ ."

[0155]

The result of having estimated the intermediate layer's thickness distribution as the working

example 1 similarly is shown in Table 22. The normal of the flat surface which three points adjacent in each point within a field make from the height information acquired by AFM makes the altitude of a substrate, and the angle to make an angle of inclination, and an average tilt angle averages them in a field here.

[0156]

Each average thickness was 2.0 micrometers. The sample of real 6A, real 6B, and real 6C was carrying out form of island shape, and the thickness of the portion which makes the circumference of island shape was 50% or less of average thickness. The sample of the ratio 6 had not carried out form of island shape, although there was unevenness. It checked that the indium oxide deposited for the use of the mask was removed from the sample of real 6A, real 6B, and real 6C being thinner than the thickness which the greatest thickness deposited in the sputtering.

[0157]

[Table 21]

	1	5
	光入射側の面の 平均傾斜角(°)	その反対側の面の 平均傾斜角(^)
比6	10, 7	13. 7
実6A	13. 5	13. 7
実6B	16. 8	13. 6
実6 C	18. 3	13. 9

[0158]

Next, the current potential characteristic of the produced optoelectric transducer was measured like the working example 1. The result is shown in Table 23. A relative value with the comparative example 6 shows a result.

[0159] [Table 22]

表23					
	Jse	FF	Voc	Eff.	Rsh
実6A/比6	1.002	1.032	1.017	1.052	3.12×10 ²
実6B/比6	1.011	1.034	1.018	1.064	4.29×10^{2}
実6C/比6	1.012	1.033	1.015	1.061	4. 55×10 ²

[0160]

Although short circuit photoelectric current of real 6C and real 6B is increasing rather than the ratio 6, real 6A is hardly increasing. This result showed that it was alike rattlingly and photoelectric conversion efficiency was improving more with a larger average tilt angle of unevenness of Men of the light incidence side than the average tilt angle of unevenness of Men of that opposite hand.

[0161]

The spectral sensitivity characteristic was measured like the working example 5, and the short circuit photoelectric current of the 1st photoelectromotive-force layer and the short circuit photoelectric current of the 2nd photoelectromotive-force layer were searched for.

[0162]

The ratio [as opposed to / carry out sample Seki and / the comparative example 6 for a result] of three pieces of the working example 6 shows to Table 24.

[0163]

[Table 23]

	第1の光起電力層	第3の光起電力層
実6A	1.001	0.996
実6B	1.011	1.016
実6 C	1.012	1.019

[0164]

Although the short circuit photoelectric current of the 1st photoelectromotive-force layer and the short circuit photoelectric current of real 6C and real 6B of the 2nd photoelectromotive-force layer are increasing rather than the ratio 6, real 6A is hardly increasing. [0165]

The above result showed that it is alike rattlingly, and dispersion of light increased more, absorption in a photoelectromotive-force layer increased, and photoelectric conversion efficiency was improving by the increase in short circuit photoelectric current with a larger average tilt angle of unevenness of Men of the light incidence side than the average tilt angle of unevenness of Men of the opposite hand.

[0166]

[Effect of the Invention]

As explained above, in this invention, by providing the intermediate layer of island shape in a lamination type photovoltaic cell, the influence of the defect which short circuit photoelectric current increased and was generated in the photoelectromotive-force layer is reduced, and good open circuit voltage and a curvilinear factor are obtained. Therefore, high photoelectric conversion efficiency is acquired. Cost can be reduced by Kami who manufactures since the influence of a defect can be reduced easily.

[Brief Description of the Drawings]

[Drawing 1]It is a mimetic diagram showing the concept of the intermediate layer of island shape.

[Drawing 2] Although it is the same unevenness, it is a key map of an intermediate layer when average thickness is thick.

<u>[Drawing 3]</u> It is a mimetic diagram of the course of the leakage current in case a defect exists in a photoelectromotive-force layer.

[Drawing 4]It is a schematic view showing typically the section structure of one embodiment of the lamination type photovoltaic cell of this invention.

[Drawing 5] It is a schematic view showing typically the section structure of other one embodiments of the lamination type photovoltaic cell of this invention.

[<u>Drawing 6</u>] except for not having the intermediate layer — the lamination type photovoltaic cell of this invention — it is a schematic view showing typically the section structure of the lamination type photovoltaic cell of the same composition.

[<u>Drawing 7</u>]Since the semiconductor layer of the lamination type photovoltaic cell of this invention is deposited, it is a minetic diagram showing one form of suitable equipment. [Explanations of letters or numerals]

- 101 The boundary of an island
- 102 Island
- 103 The portion which makes the circumference of an island

- 104 The intermediate layer of island shape
- 105 Photoelectromotive-force layer
- 106 50% of line of average thickness
- 201 Intermediate layer
- 202 Photoelectromotive-force layer
- 203 50% of line of average thickness
- 301 The intermediate layer of island shape
- 302 Photoelectromotive-force laver
- 303 Defect
- 304 The portion which makes the circumference of an island
- 305 Island
- 306 Leakage current
- 402 Reflecting layer
- 402 Renecting layer
- 403 The 2nd photoelectromotive-force layer
- 404 Intermediate layer
- 405 The 1st photoelectromotive-force layer element 406 Transparent electrode
- 501 Substrate
- 502 Reflecting laver
- 503 The 2nd photoelectromotive-force layer
- 504 Intermediate layer
- 505 The 1st photoelectromotive-force layer
- 506 Transparent electrode
- 601 Substrate
- 602 Reflecting layer
- 603 The 2nd photoelectromotive-force layer
- 604 The 1st photoelectromotive-force layer element
- 605 Transparent electrode
- 701 Load chamber
- 702 N laver chamber
- 703 Micro crystallite i layer chamber
- 704 Amorphous i layer chamber
- 705 p layer chamber
- 706 Unloading chamber
- 707, 708, 709, 710, and 711 Gate valve
- 712 The heater for micro crystallite i layer board heating
- 713 Micro crystallite i layer plasma-CVD room
- 714 The heater for n layer board heating
- 715 N layer plasma-CVD room
- 716 The heater for amorphous i layer board heating
- 717 i layer plasma-CVD room
- 718 The heater for p layer board heating
- 719 p layer plasma-CVD room
- 720 Electrode-holder carrying rails
- 721 Substrate holder